

# Test Report



## INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C and INDUSTRY CANADA REQUIREMENTS

Equipment Under Test: Bluetooth dongle  
Model: BLE113  
Type: -  
Manufacturer: Bluegiga Oy  
Sinikalliontie 5 A  
FI-02630 ESPOO  
Finland  
Customer: Bluegiga Oy  
Sinikalliontie 5 A  
FI-02630 ESPOO  
Finland  
FCC Rule Part 15.247: 2012  
KDB:: 558074 D01 DTS Meas Guidance v03r01  
IC Rule Part RSS-210, Issue 8, 2010  
RSS-GEN Issue 3, 2010

Date: 26.4.2013

Issued by:

A blue ink signature of Jari Merikari.

Jari Merikari  
Technical Manager

Date: 26.4.2013

Checked by:

A blue ink signature of Ari Honkala.

Ari Honkala  
Product Line Manager

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## Equipment Under Test (EUT)

Bluetooth module  
 Model: BLE113  
 Type: -  
 Serial no: -  
 HW version: -  
 SW version: -  
 FCC ID number: QOQBLE113  
 Industry Canada number: 5123A-BLE113

## Description of the EUT

The EUT is a Bluetooth low energy single mode module targeted for low power sensors and accessories. Device can be used with batteries or from DC power supply.

## Classification of the device

Fixed device	<input type="checkbox"/>
Mobile Device (Human body distance > 20cm)	<input checked="" type="checkbox"/>
Portable Device (Human body distance < 20cm)	<input type="checkbox"/>

## Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing

## Ratings and declarations

Operating Frequency Range (OFR): 2402 – 2480 MHz  
 Channels: 40  
 Channel separation: 2 MHz  
 Channel bandwidth: 674.4 kHz  
 Conducted power: 0.54 dBm  
 Transmission technique: Digital Transmission  
 Modulation: GFSK  
 Antenna connector type: Internal antenna  
 Antenna gain: 0.5 dBi

## Power Supply

Battery operated  
 Operating voltage range: 2,0 – 3,6 VDC  
 Normal input voltage: 3.0 V coin battery or 2 x 1,5V AAA batteries  
 Tested by using external power supply and 3.6 VDC voltage level

**Mechanical Size of the EUT**

Height: 1.9 mm	Width: 15.73 mm	Depth: 9.15 mm
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**Peripherals****Peripheral**

DC power supply Thandar TS3021S.

**Samples**

All tests were performed with two samples installed on to the evaluation board provided by the client.

Sample A: equipped with 50Ω connector

Sample B: normal construction.

All conducted measurements were made to sample A, and radiated measurements to sample B.

No modifications were done during the tests.

## **Disclaimer**

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## SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.247(b)(3) / RSS-210 A8.4	Maximum Peak Conducted Output Power	PASS
§15.247(a)(2) / RSS-210 A8.2	6 dB Bandwidth	PASS
§15.247(e) / RSS-210 A8.2	Power Spectral Density	PASS
RSS-GEN 4.6.1	99% Occupied Bandwidth	PASS
§15.247(d) / RSS-210 A8.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	PASS
§15.209(a), §15.247(d) / RSS-210 A8.5	Radiated Emissions Within The Restricted Bands	PASS
§15.109 / RSS-GEN 7.2.3.2	Unintentional Radiated Emissions	PASS
§15.207 / RSS-GEN 7.2.2	Conducted emissions	PASS

### EUT Test Conditions During Testing

The EUT was in continuous transmit mode during all the tests.

The hopping was stopped and the EUT was configured into the wanted channel. Normal modulation and duty cycle was applied in all the tests.

Following channels were used during the tests when the hopping was stopped:

Channel LOW (CH 0) = 2402 MHz

Channel MID (CH 20) = 2442 MHz

Channel HIGH (CH 39) = 2480 MHz

### Test Facility

<input type="checkbox"/> Testing Location / address: FCC registration number: <b>90598</b>	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
<input checked="" type="checkbox"/> Testing Location / address: FCC registration number: <b>178986</b> Industry Canada registration number: <b>8708A-2</b>	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

**Maximum Peak Conducted Output Power**

**Standard:** ANSI C63.10 (2009)  
**Tested by:** JJM  
**Date:** 5.4.2013  
**Humidity:** 18 %  
**Temperature:** 23 °C  
**Measurement uncertainty** ± 2,87dB Level of confidence 95 % (k = 2)

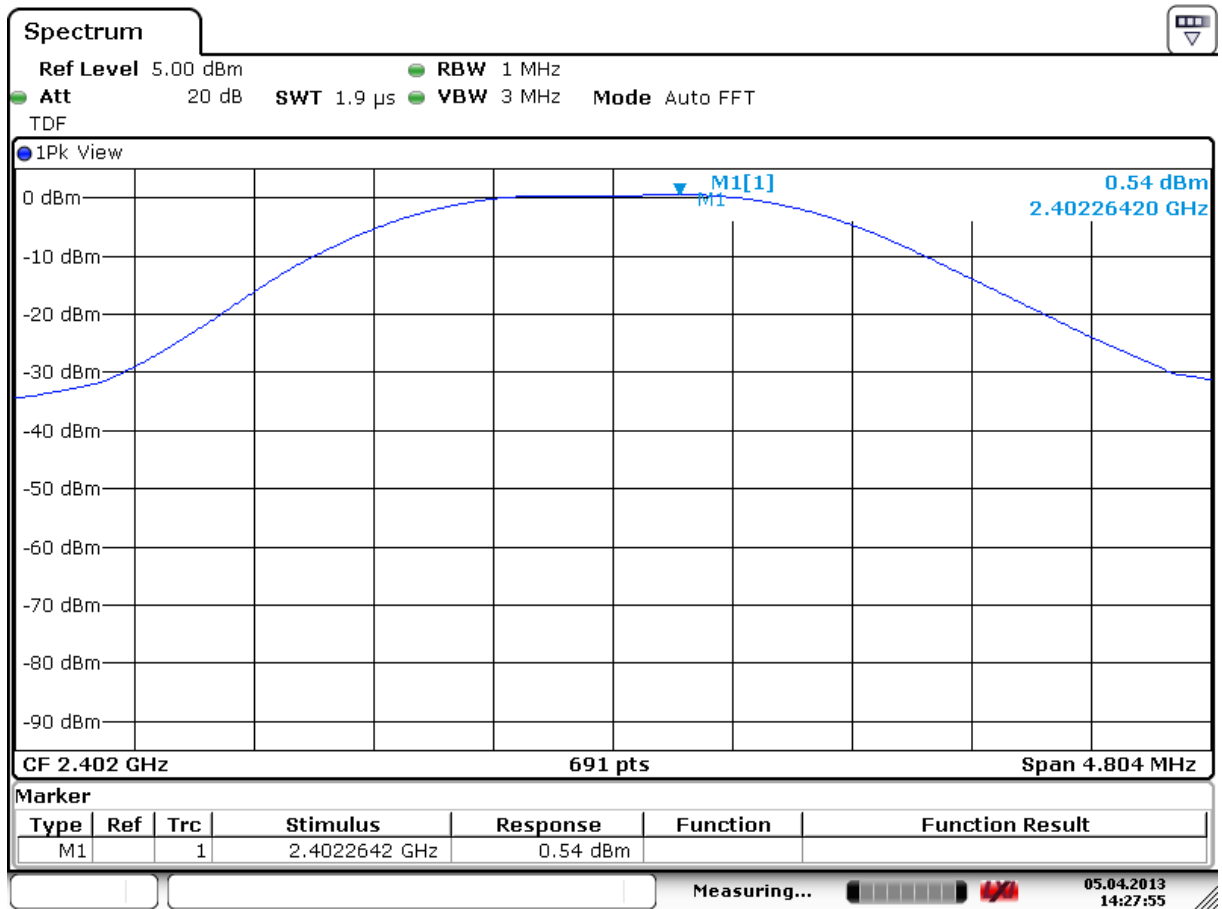
**FCC Rule: 15.247(b) (1)**

For frequency hopping systems operating in the 2400-2483.5 MHz, employing less than 75 channels limit is 0.125 Watt. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

**Results:**

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	0.54	30	29.46	PASS
Mid	-0.39	30	30.39	PASS
High	-1.27	30	31.27	PASS

## Conducted Output Power Test

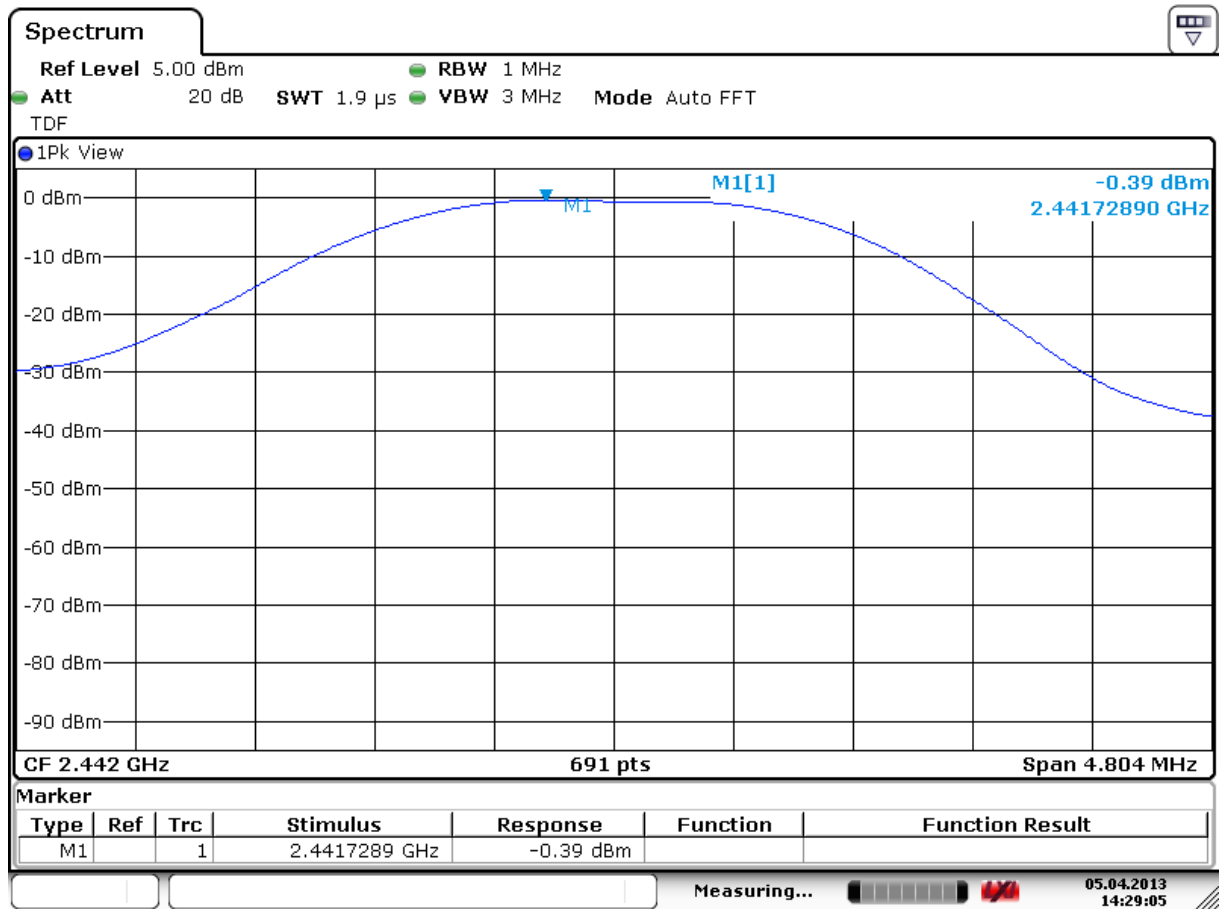


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Figure 1. Channel LOW.



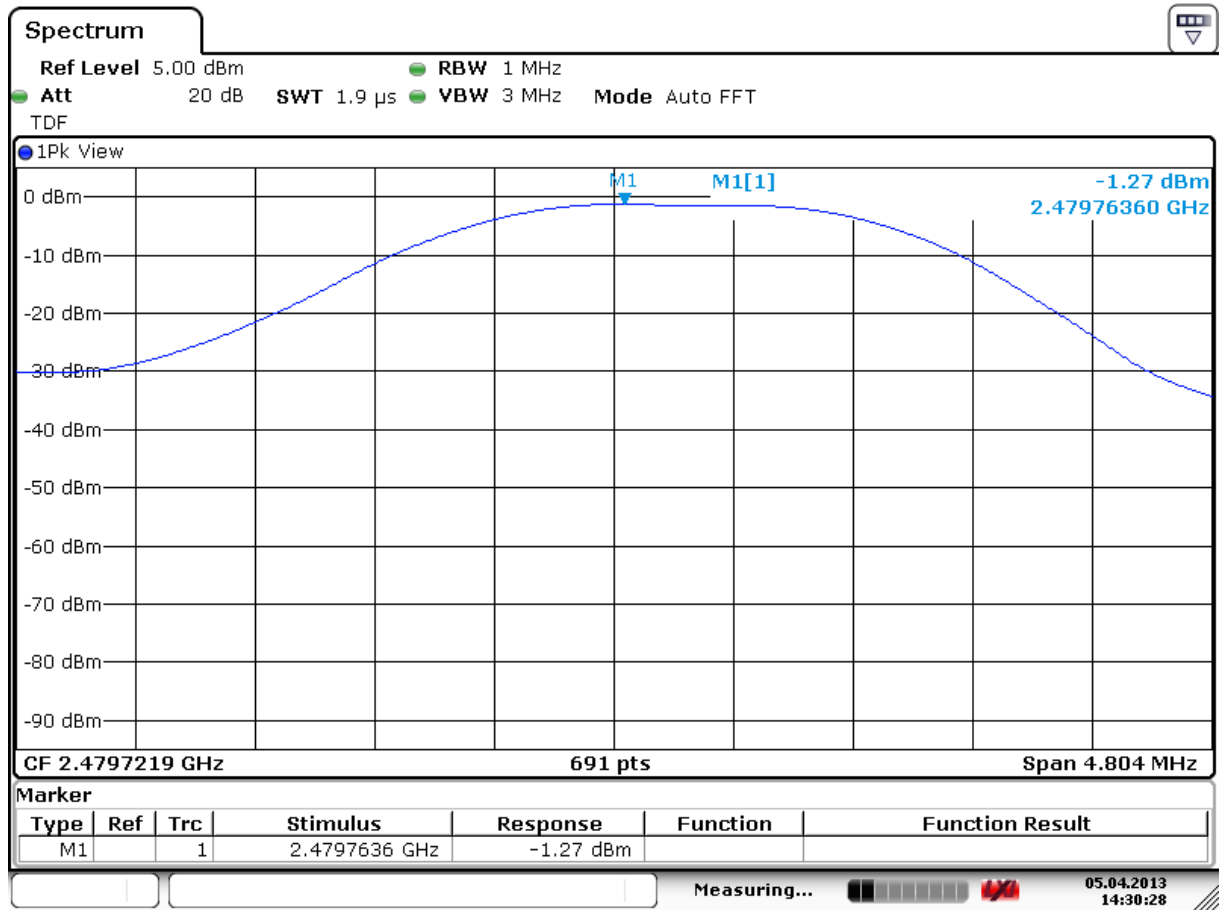
## Conducted Output Power Test



Date: 5.APR.2013 14:29:05

Figure 2. Channel MID.

## Conducted Output Power Test



Date: 5.APR.2013 14:30:28

Figure 3. Channel HIGH.

**Transmitter Radiated Emissions 30 – 1000 MHz**

<b>Standard:</b>	ANSI C63.10	(2009)
<b>Tested by:</b>	JJM	
<b>Date:</b>	22 – 23.4.2013	
<b>Humidity:</b>	20 - 21%	
<b>Temperature:</b>	19 °C	
<b>Measurement uncertainty</b>	± 4.51 dB	Level of confidence 95 % (k = 2)

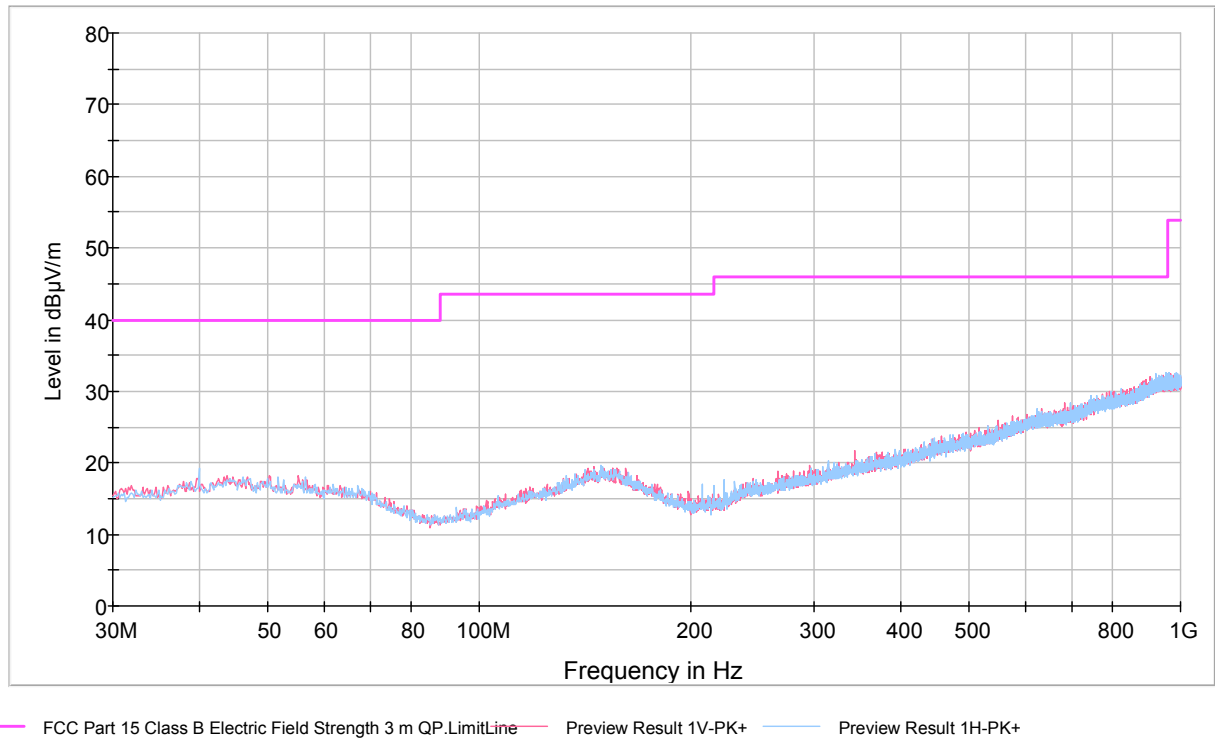
**FCC Rule: 15.247(d), 15.209(a)**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables). The QuasiPeak value is the measured value corrected with the correction factor.

**Measured Peak Values In The Frequency Range 30 MHz - 1000 MHz.**

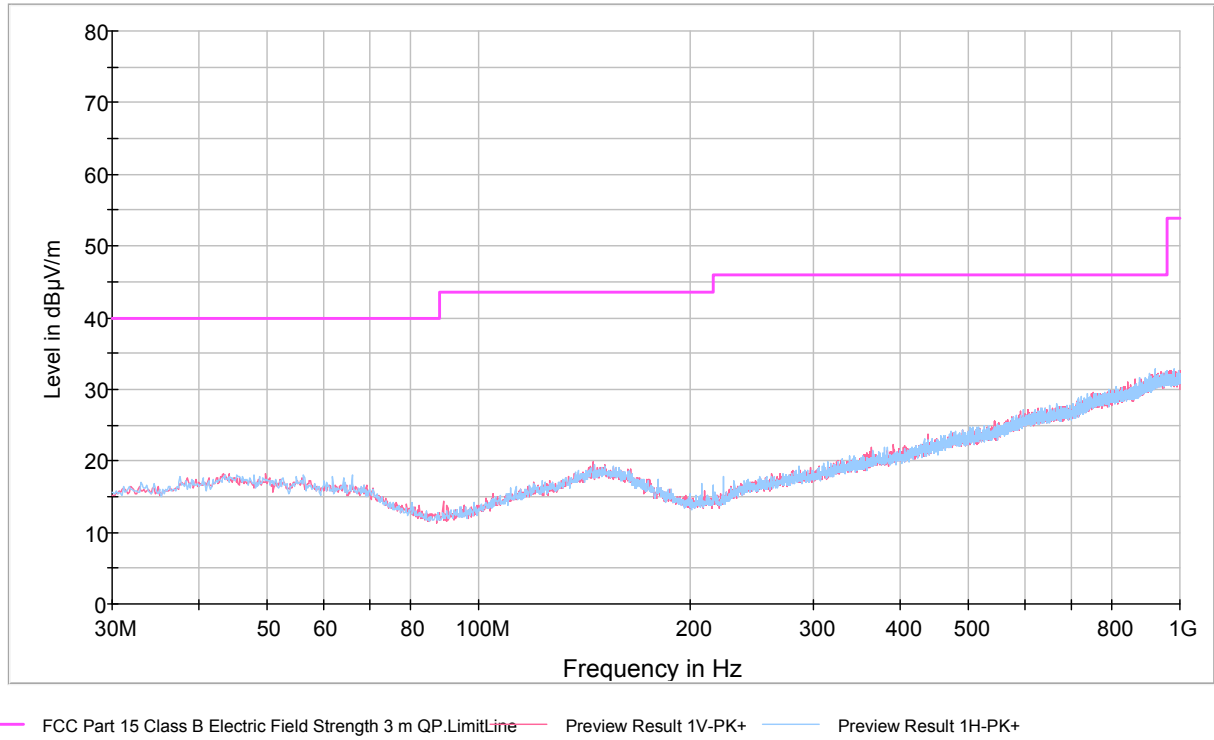
FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 4.** Measured curve with peak-detector. Channel LOW.

**No final measurements were made since the emission level was more than 10 dB from the limit.**

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 5.** Measured curve with peak-detector. Channel MID.

**No final measurements were made since the emission level was more than 10 dB from the limit.**

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

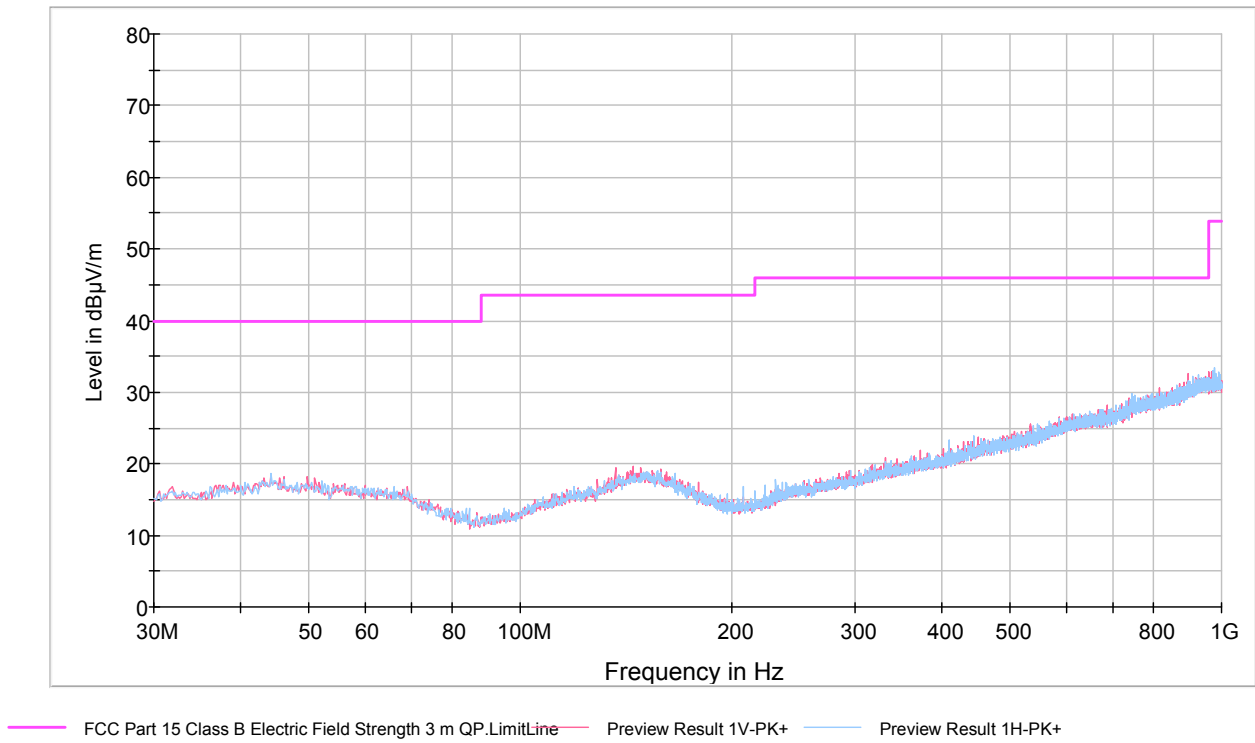


Figure 6. Measured curve with peak-detector. Channel HIGH.

No final measurements were made since the emission level was more than 10 dB from the limit.

## Transmitter Radiated Emissions 1 000 – 26 500 MHz

### Measured Peak and Average Values In The Frequency Range 1 000 MHz – 4 000 MHz.

The correction factor in the final result tables contains the sum of the transducers (antenna + amplifier + cables). The Max Peak and Average values are measured values corrected with the correction factor.

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

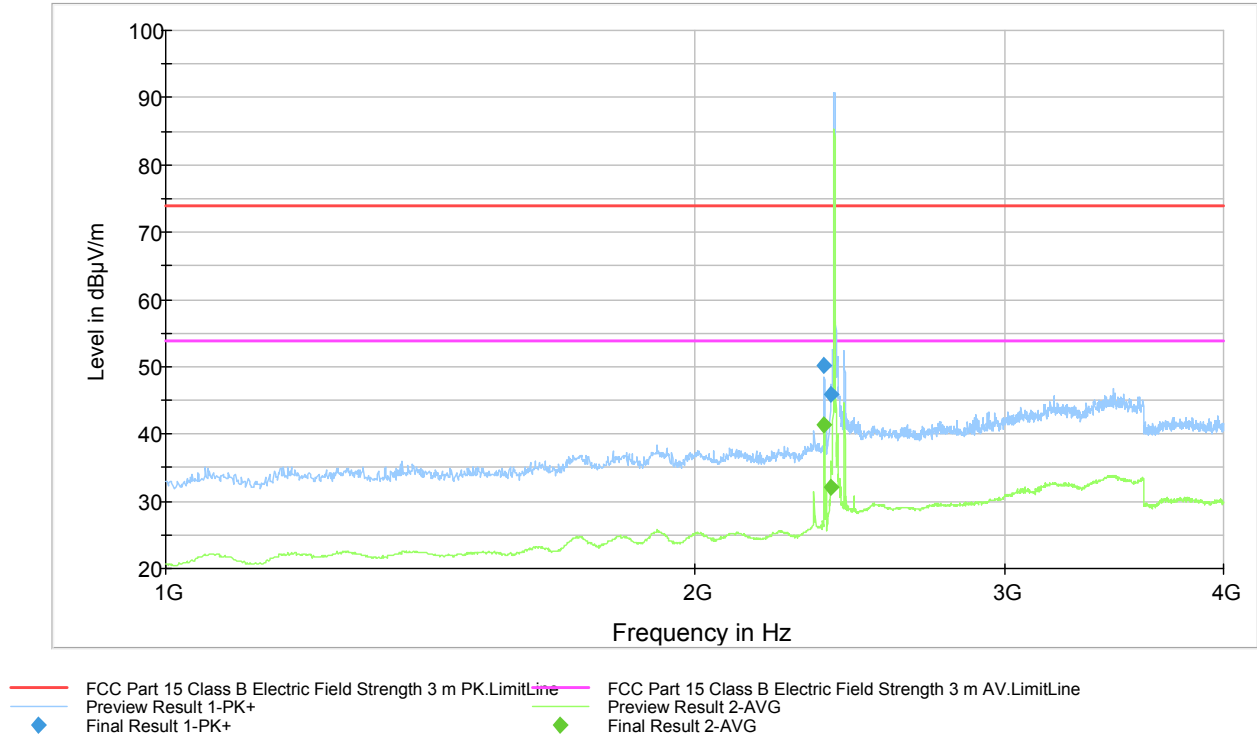


Figure 7. Measured curve with peak- and average detector. Channel LOW.

### Final measurements from the worst frequencies

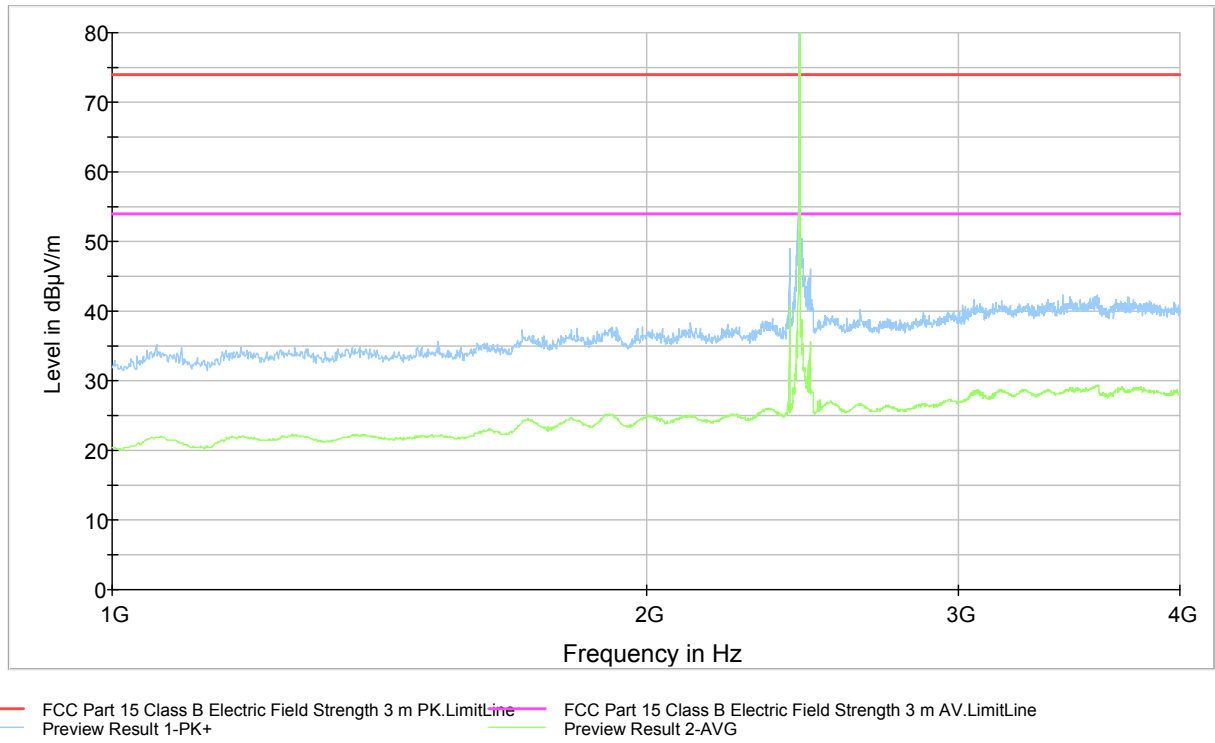
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2369.775000	50.2	1000.0	1000.000	100.0	V	266.0	0.5	23.7	73.9
2390.000000	45.9	1000.0	1000.000	100.0	V	296.0	0.6	28.0	73.9

Table 1. Final Max Peak results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2370.025000	41.4	1000.0	1000.000	100.0	V	266.0	0.5	12.5	53.9
2389.600000	32.1	1000.0	1000.000	100.0	V	266.0	0.6	21.8	53.9

Table 2. Final Average results.

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

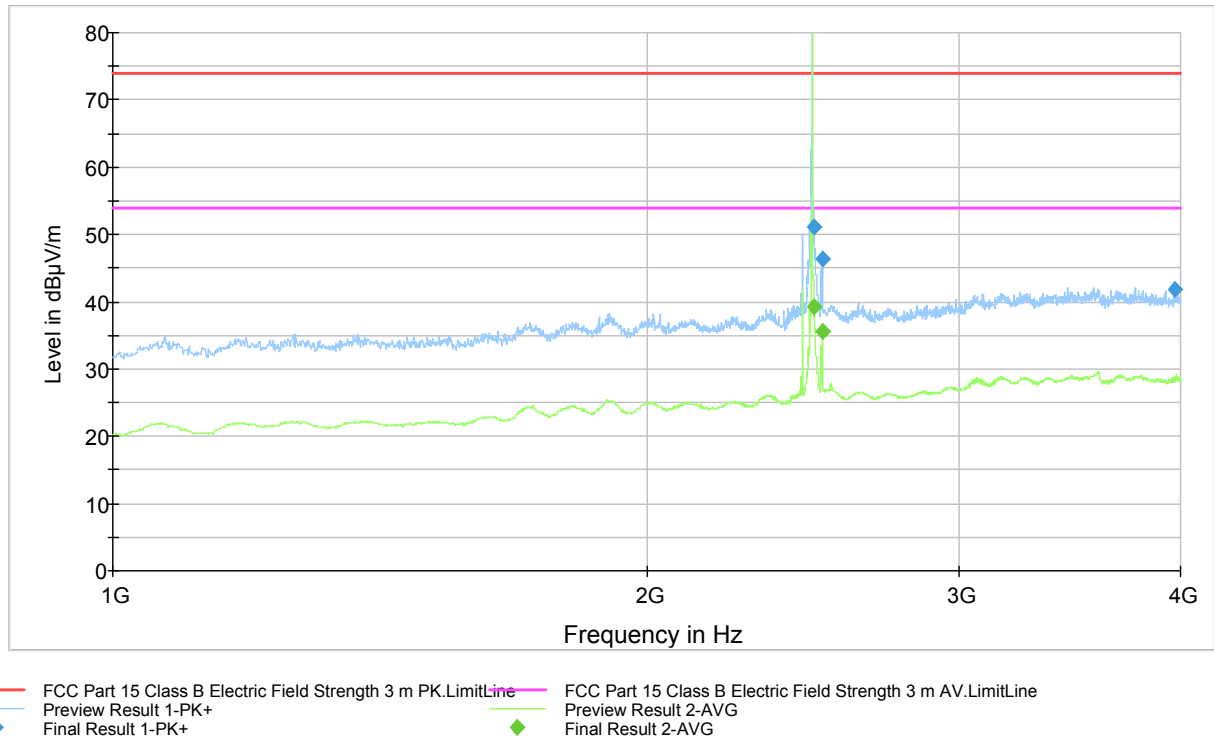


**Figure 8.** Measured curve with peak- and average detector. Channel MID.

**No final measurements were made since the peak level of the emission was below the average limit line outside the assigned operating band.**



FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



**Figure 9.** Measured curve with peak- and average detector. Channel HIGH.

**Final measurements from the worst frequencies**

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2485.100000	51.2	1000.0	1000.000	100.0	V	270.0	1.0	22.7	73.9
2512.275000	46.4	1000.0	1000.000	100.0	V	283.0	1.2	27.5	73.9
3971.525000	41.8	1000.0	1000.000	154.0	V	0.0	6.7	32.1	73.9

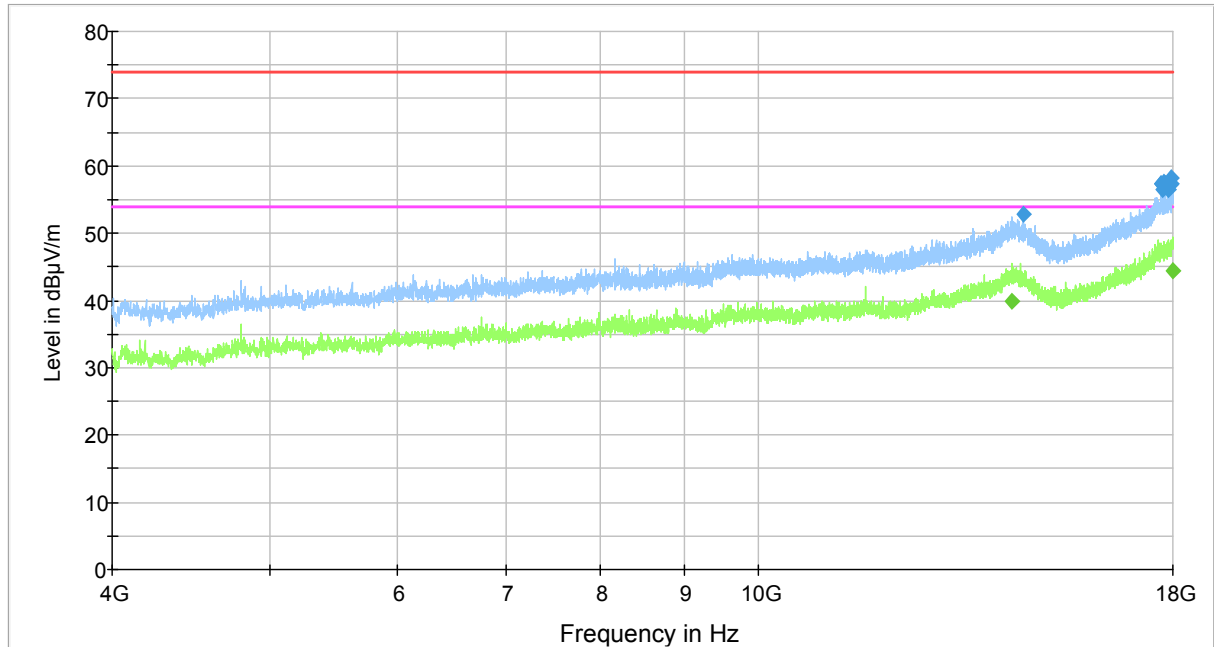
**Table 3.** Final Max Peak results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2485.100000	39.3	1000.0	1000.000	105.0	V	287.0	1.0	14.6	53.9
2512.025000	35.6	1000.0	1000.000	138.0	V	289.0	1.2	18.3	53.9

**Table 4.** Final Average results.

Measured Peak and Average Values In The Frequency Range 4 000 MHz – 18 000 MHz.

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine  
— FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine  
— Preview Result 1-PK+ — Preview Result 2-AVG  
◆ Final Result 1-PK+ ◆ Final Result 2-AVG

Figure 10. Measured curve with peak- and average detector. Channel LOW.

Final measurements from the worst frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
14552.600000	52.9	1000.0	1000.000	100.0	V	95.0	23.5	21.0	73.9
17701.800000	57.4	1000.0	1000.000	100.0	V	17.0	28.5	16.5	73.9
17716.600000	57.4	1000.0	1000.000	275.0	H	164.0	28.4	16.5	73.9
17760.400000	56.5	1000.0	1000.000	400.0	V	192.0	28.2	17.4	73.9
17780.800000	57.5	1000.0	1000.000	179.0	V	173.0	28.4	16.4	73.9
17825.600000	57.3	1000.0	1000.000	100.0	V	242.0	28.6	16.6	73.9
17881.000000	56.6	1000.0	1000.000	154.0	V	238.0	29.0	17.3	73.9
17921.000000	57.2	1000.0	1000.000	284.0	V	90.0	29.3	16.7	73.9
17964.000000	57.4	1000.0	1000.000	391.0	V	249.0	29.4	16.5	73.9
17979.200000	58.1	1000.0	1000.000	154.0	H	236.0	29.5	15.8	73.9

Table 5. Final Max Peak results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
14314.600000	39.8	1000.0	1000.000	362.0	V	200.0	24.0	14.1	53.9
17996.600000	44.4	1000.0	1000.000	337.0	V	200.0	29.6	9.5	53.9

Table 6. Final Average results.

FCC Part 15 Class B Spurious Emission 4-18GHz 3m

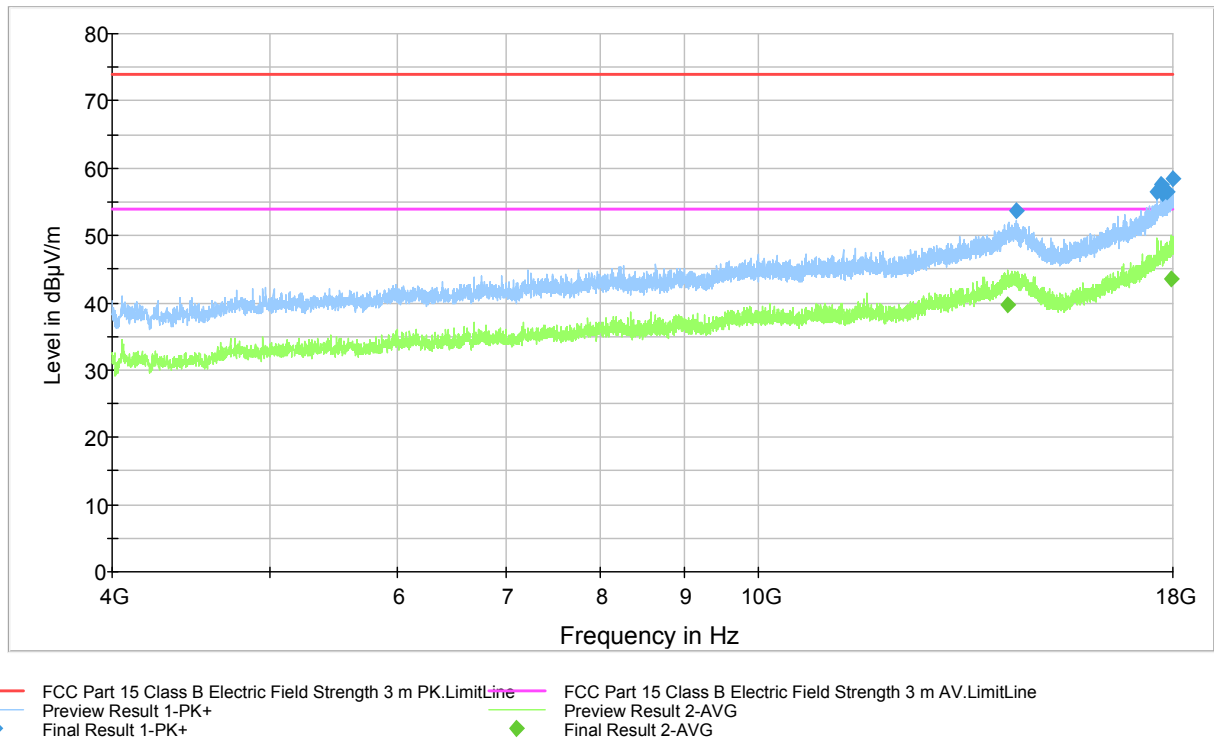


Figure 11. Measured curve with peak- and average detector. Channel MID.

Final measurements from the worst frequencies

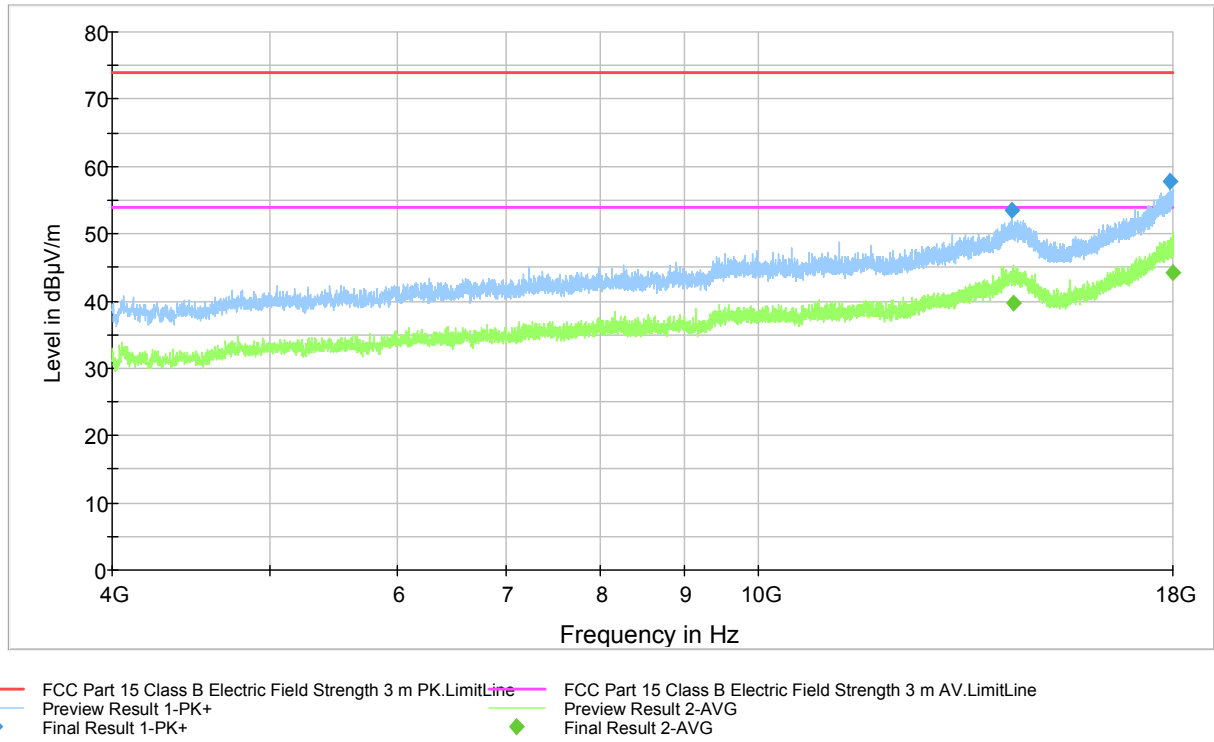
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
14414.400000	53.7	1000.0	1000.000	374.0	H	30.0	23.9	20.2	73.9
17595.200000	56.5	1000.0	1000.000	385.0	H	48.0	27.9	17.4	73.9
17700.400000	57.5	1000.0	1000.000	299.0	H	304.0	28.5	16.4	73.9
17741.600000	56.3	1000.0	1000.000	376.0	H	32.0	28.1	17.6	73.9
17840.400000	56.5	1000.0	1000.000	146.0	H	168.0	28.6	17.4	73.9
17997.800000	58.5	1000.0	1000.000	296.0	V	320.0	29.7	15.4	73.9

Table 7. Final Max Peak results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
14248.600000	39.7	1000.0	1000.000	354.0	V	19.0	23.8	14.2	53.9
17959.200000	43.6	1000.0	1000.000	378.0	H	242.0	29.4	10.3	53.9

Table 8. Final Average results.

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 12.** Measured curve with peak- and average detector. Channel HIGH.

**Final measurements from the worst frequencies**

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
14323.200000	53.4	1000.0	1000.000	329.0	V	327.0	24.0	20.5	73.9
17914.200000	57.7	1000.0	1000.000	256.0	V	188.0	29.3	16.2	73.9

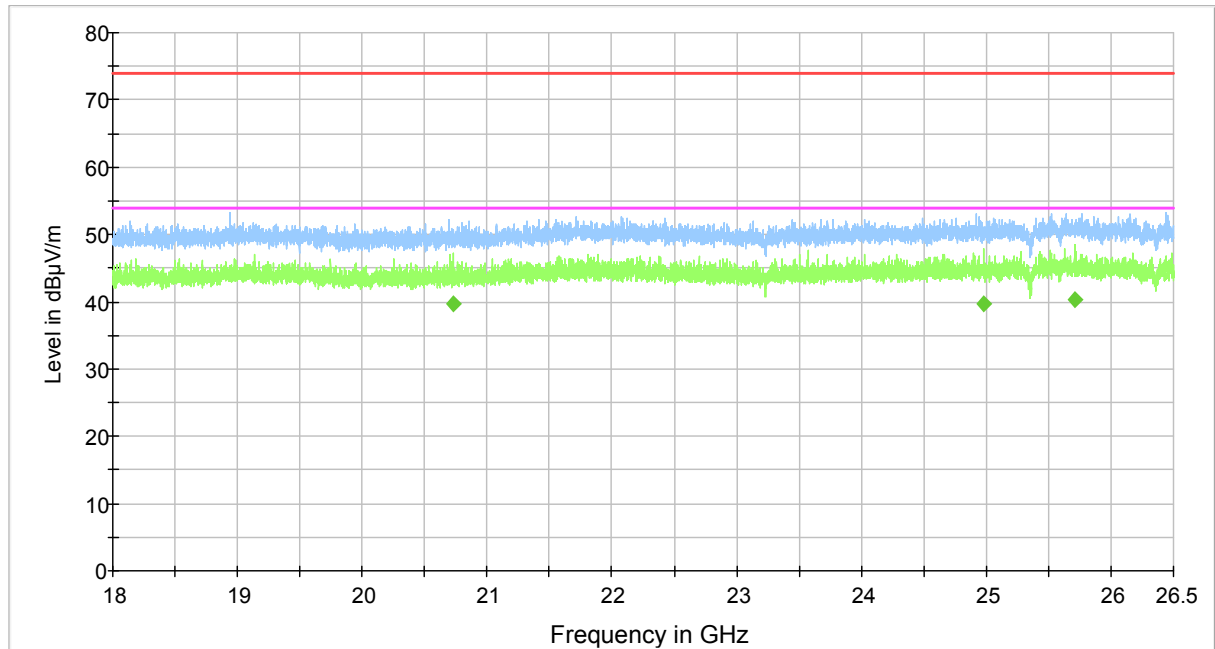
**Table 9.** Final Max Peak results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
14344.800000	39.6	1000.0	1000.000	100.0	V	147.0	23.9	14.3	53.9
17999.200000	44.3	1000.0	1000.000	203.0	V	322.0	29.7	9.6	53.9

**Table 10.** Final Average results.

**Measured Peak and Average Values In The Frequency Range 18 000 MHz – 26 500 MHz.**

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine   
 — FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine  
— Preview Result 1-PK+   
 — Preview Result 2-AVG  
◆ Final Result 2-AVG

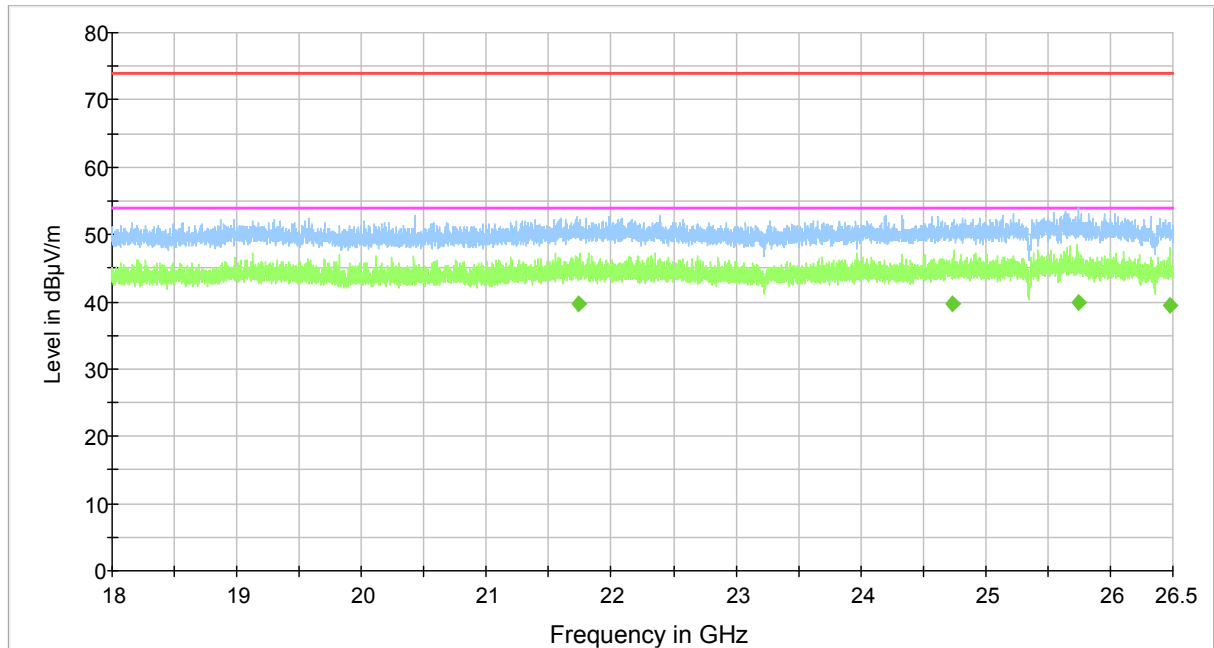
**Figure 13.** Measured curve with peak- and average detector. Channel LOW.

**Final measurements from the worst frequencies**

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
20727.650000	39.7	1000.0	1000.000	400.0	V	135.0	26.2	14.2	53.9
24977.850000	39.7	1000.0	1000.000	400.0	V	135.0	28.3	14.2	53.9
25710.800000	40.3	1000.0	1000.000	400.0	V	210.0	29.1	13.6	53.9

**Table 11.** Final Average results.

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine     — FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine  
— Preview Result 1-PK+     — Preview Result 2-AVG  
◆ Final Result 2-AVG

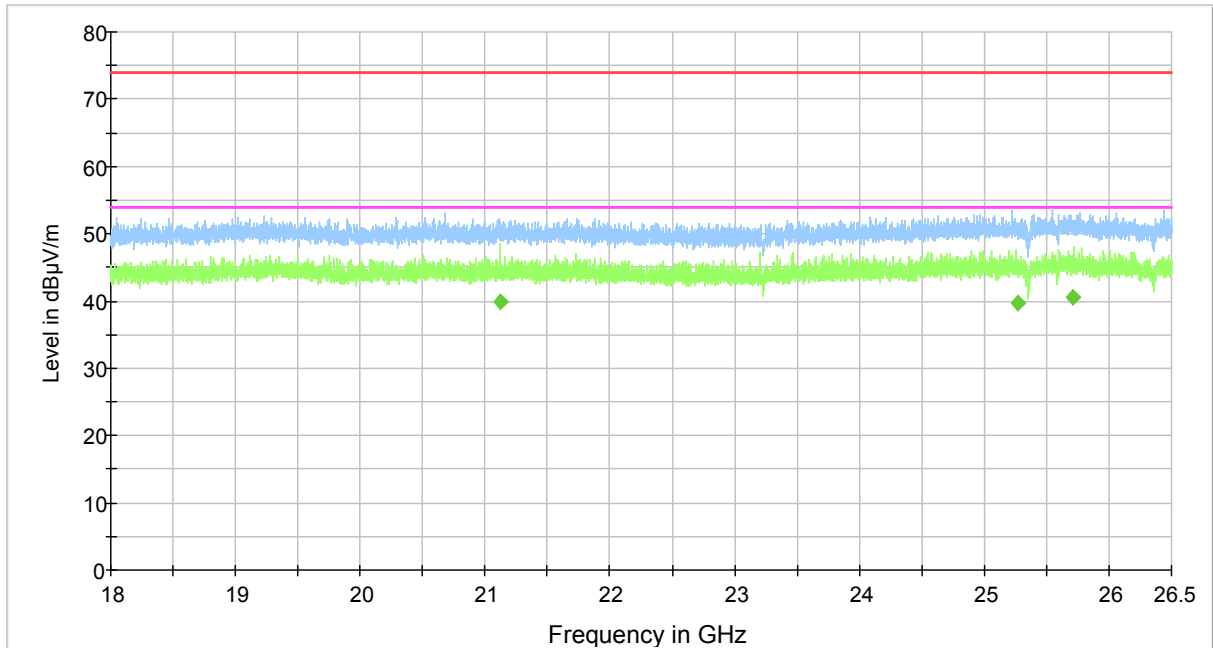
**Figure 14.** Measured curve with peak- and average detector. Channel MID.

**Final measurements from the worst frequencies**

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
21744.700000	39.7	1000.0	1000.000	397.0	V	185.0	26.8	14.2	53.9	
24738.850000	39.6	1000.0	1000.000	375.0	H	116.0	28.1	14.3	53.9	
25742.550000	39.9	1000.0	1000.000	400.0	V	210.0	29.1	14.0	53.9	
26475.450000	39.4	1000.0	1000.000	400.0	V	358.0	29.2	14.5	53.9	

**Table 12.** Final Average results.

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine     — FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine  
— Preview Result 1-PK+     — Preview Result 2-AVG  
◆ Final Result 2-AVG

**Figure 15.** Measured curve with peak- and average detector. Channel HIGH.

**Final measurements from the worst frequencies**

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
21117.900000	39.8	1000.0	1000.000	368.0	V	54.0	26.4	14.1	53.9
25263.350000	39.7	1000.0	1000.000	386.0	H	15.0	28.5	14.2	53.9
25712.550000	40.5	1000.0	1000.000	374.0	V	15.0	29.1	13.4	53.9

**Table 13.** Final Average results.

**Transmitter Band Edge Measurement and Conducted Spurious Emissions**

**Standard:** ANSI C63.10 (2009)  
**Tested by:** JJM  
**Date:** 1545.2013  
**Humidity:** 25 %  
**Temperature:** 24 °C  
**Measurement uncertainty** ± 2.87 dB Level of confidence 95 % (k = 2)

**FCC Rule: 15.247(d), 15.209(a)**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

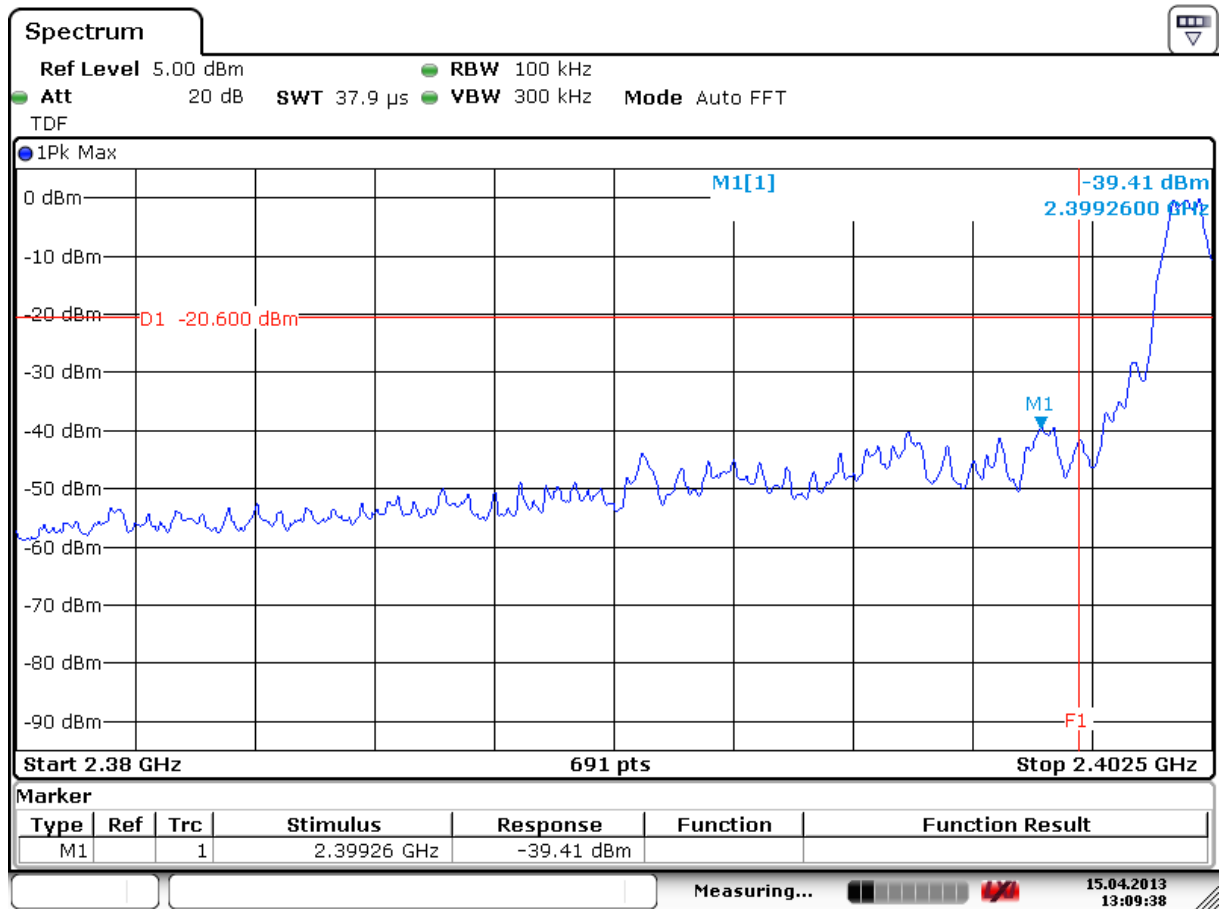
<b>Band Edge Attenuation</b>	
Lower Band Edge	Upper Band Edge
-39.41 dBc	-44.37 dBc
<b>Limit: -20dBc</b>	

**Table 14.** Band edge attenuation.

**No significant emissions were detected close to the limit.**



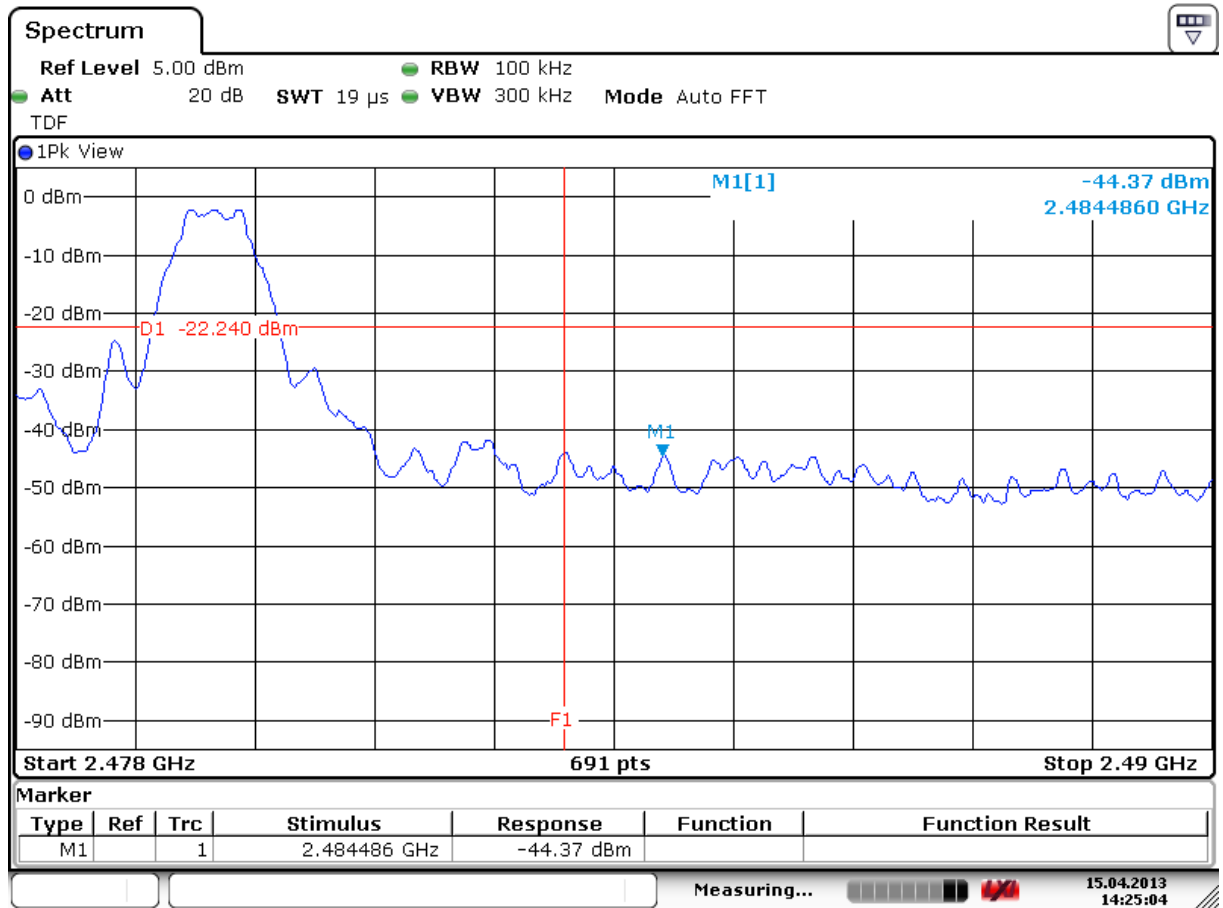
## Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 15.APR.2013 13:09:38

**Figure 16.** Lower Band Edge.

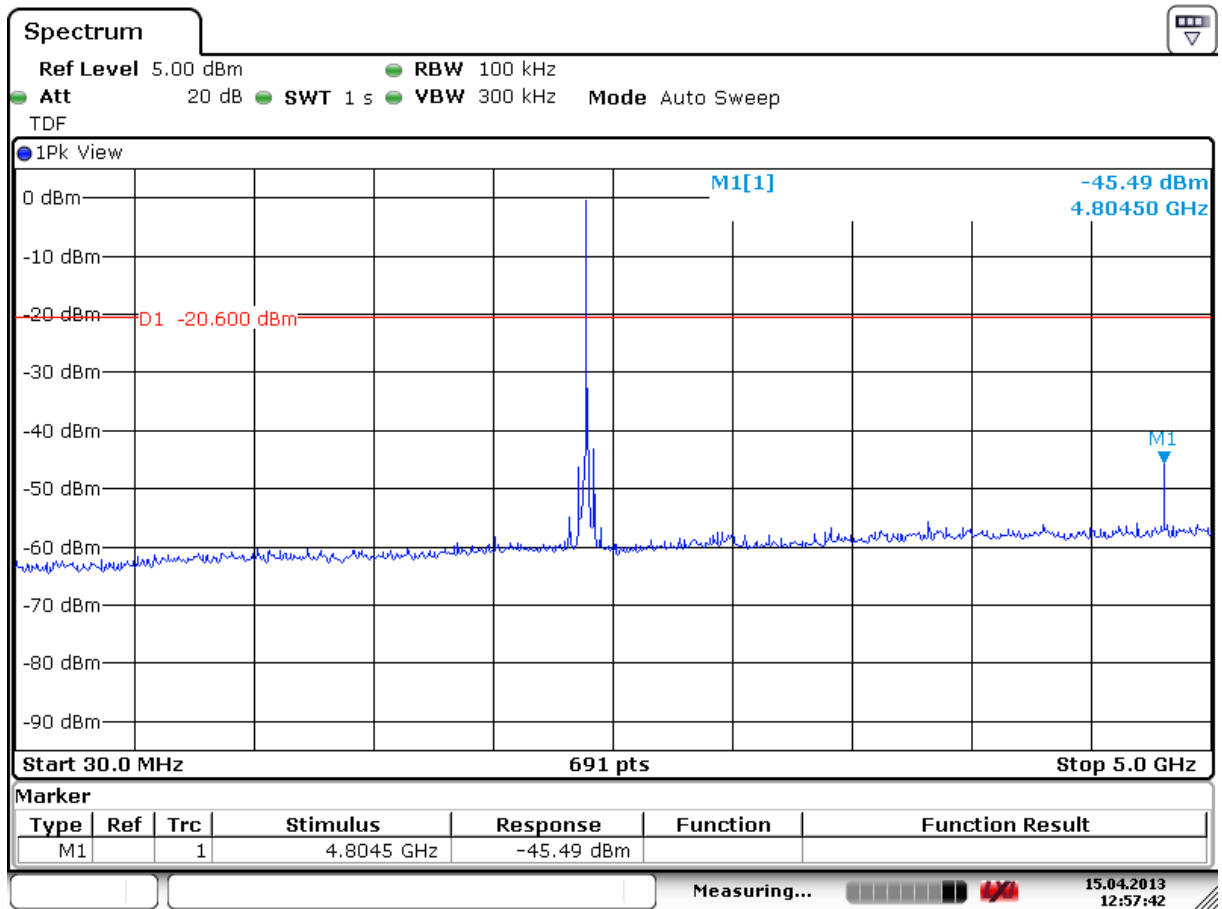
## Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 15.APR.2013 14:25:04

Figure 17. Upper Band Edge.

## Transmitter Band Edge Measurement and Conducted Spurious Emissions

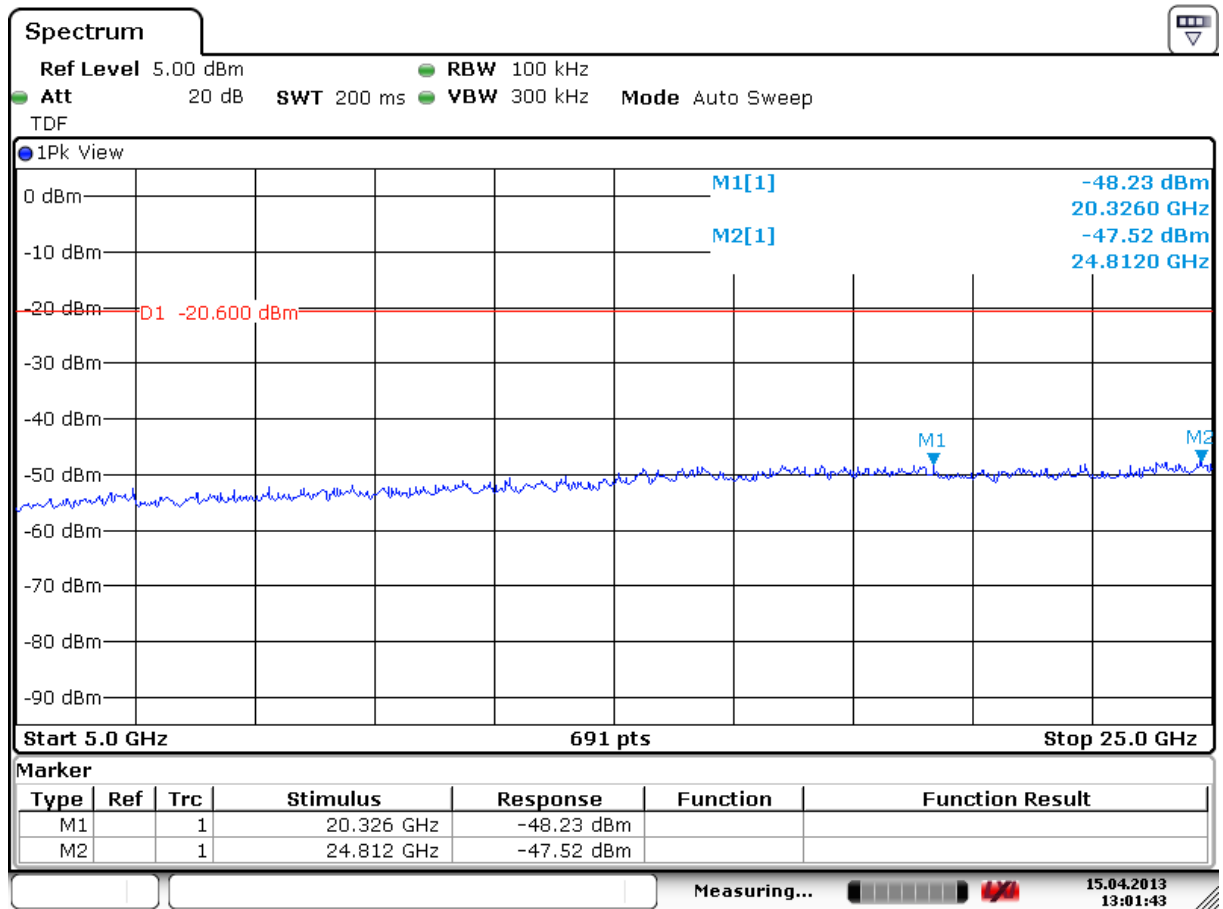


Date: 15.APR.2013 12:57:42

**Figure 18.** Conducted Spurious Emissions 30 – 5 000 MHz. Channel LOW.

**Peak over the limit is the carrier.**

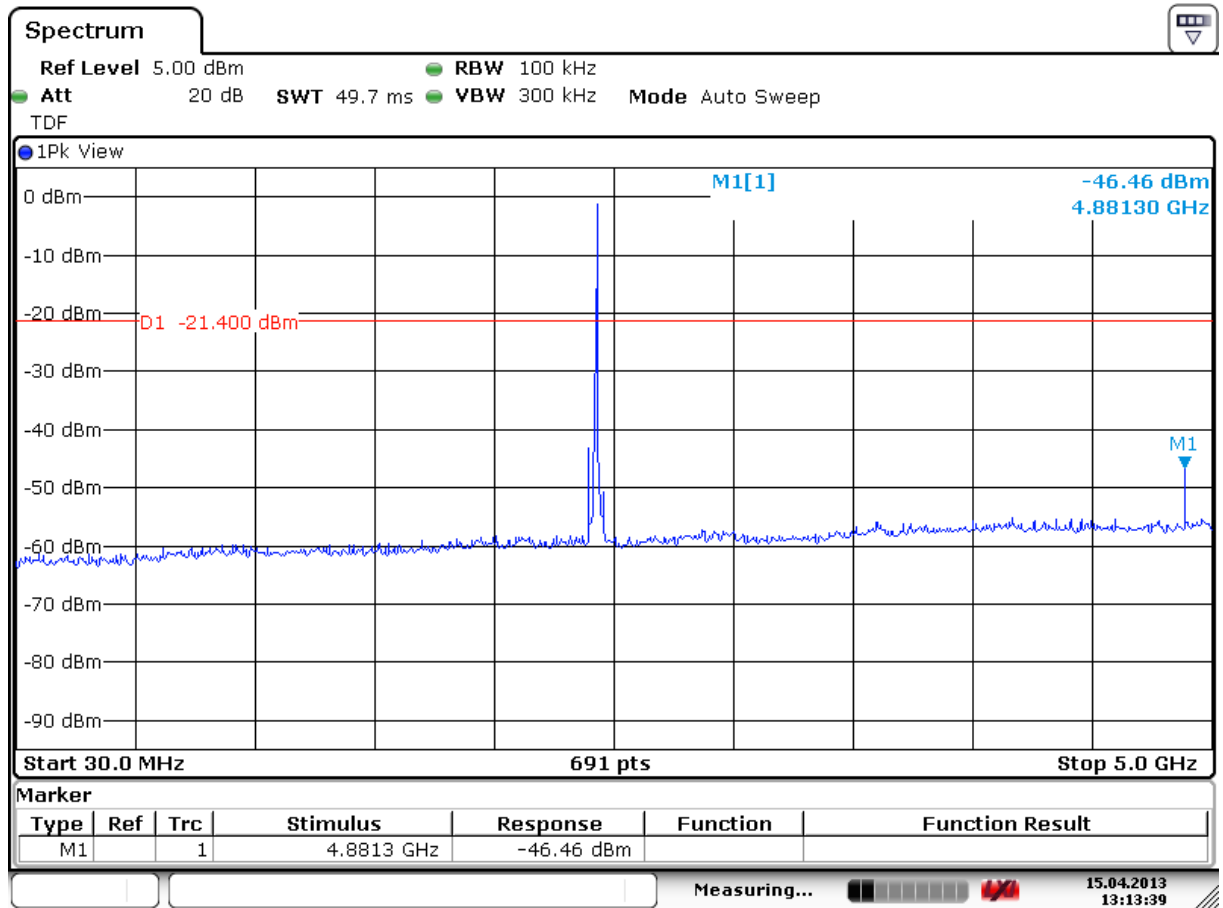
## Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 15.APR.2013 13:01:44

**Figure 19.** Conducted Spurious Emissions 5 000 – 25 000 MHz. Channel LOW.

## Transmitter Band Edge Measurement and Conducted Spurious Emissions

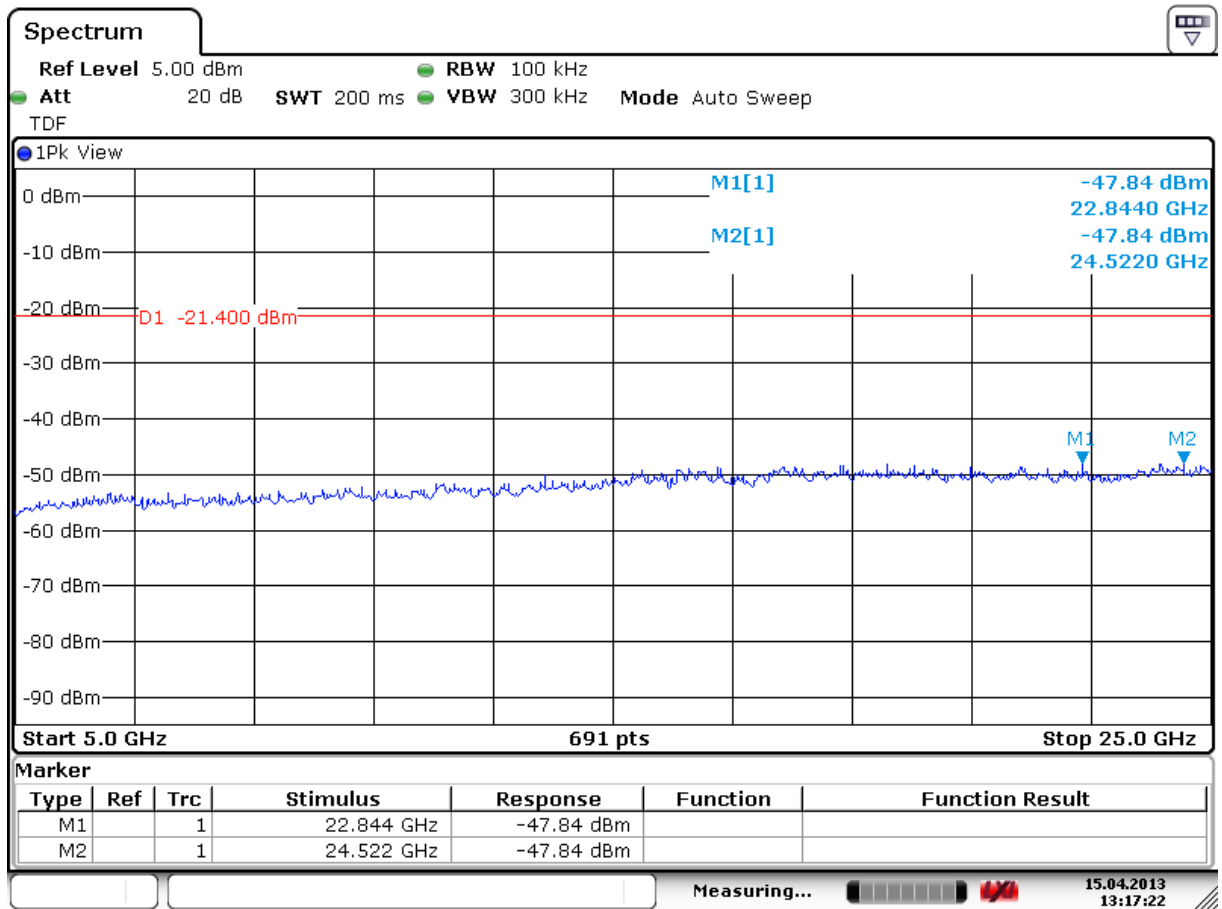


Date: 15.APR.2013 13:13:40

**Figure 20.** Conducted Spurious Emissions 30 – 5 000 MHz. Channel MID.

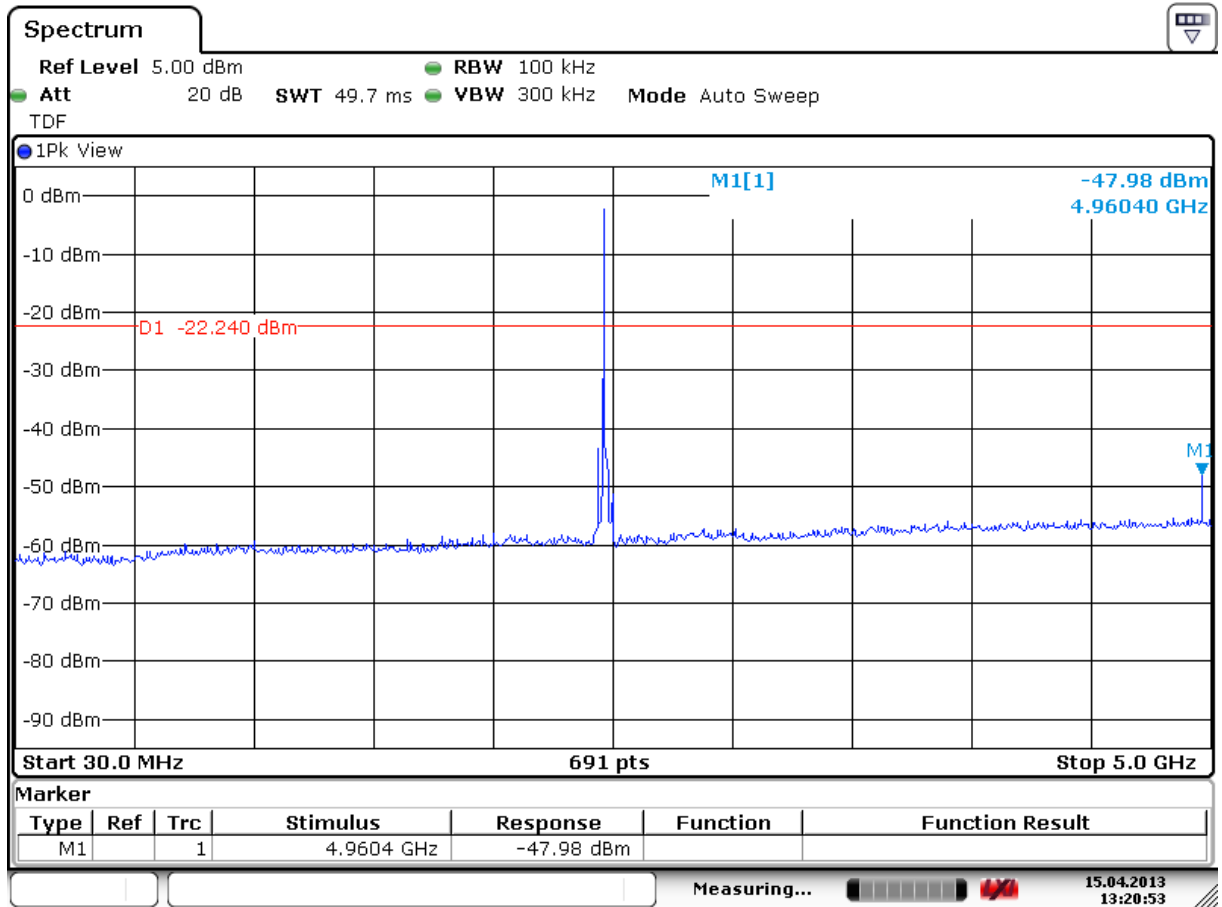
**Peak over the limit is the carrier.**

## Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 15.APR.2013 13:17:22

**Figure 21.** Conducted Spurious Emissions 5 000 – 25 000 MHz. Channel MID.

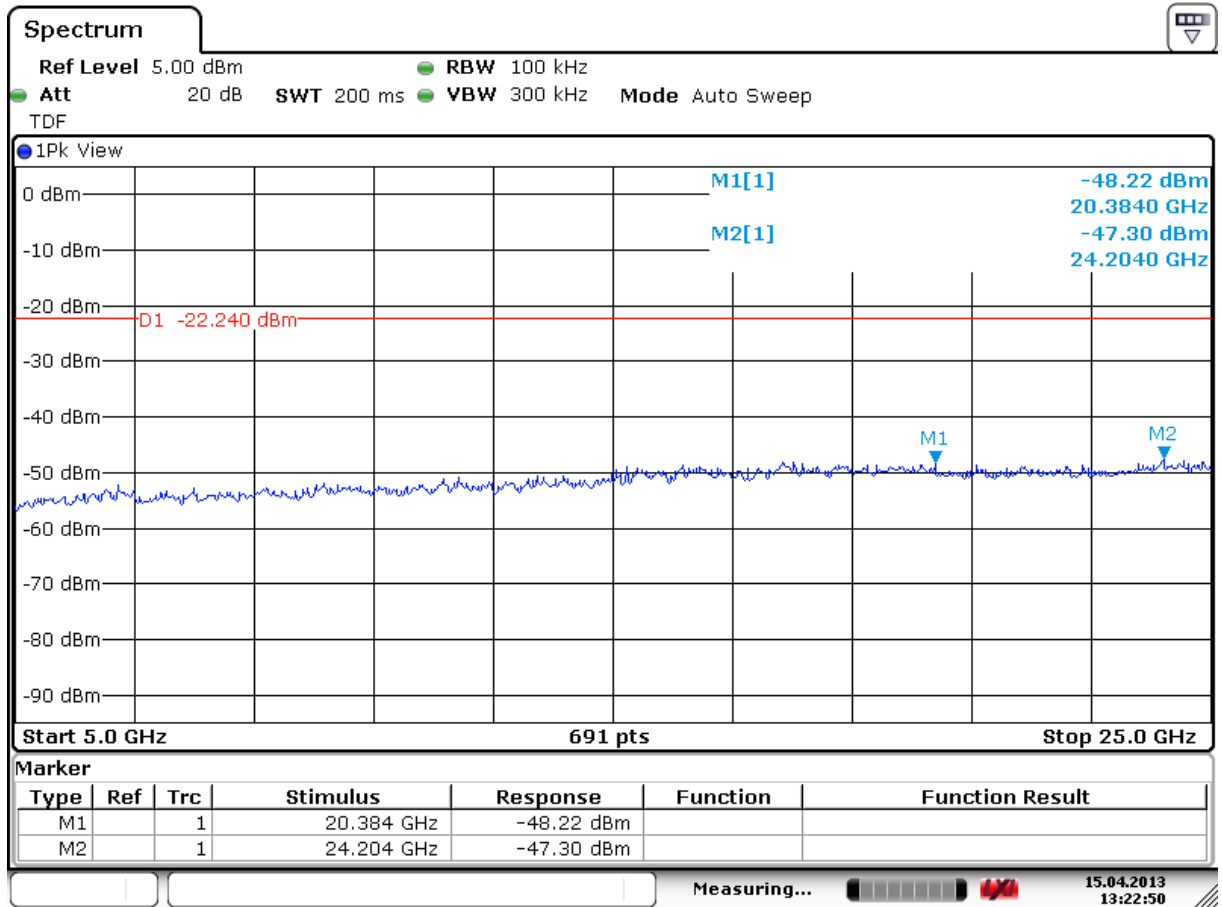


Date: 15.APR.2013 13:20:53

**Figure 22.** Conducted Spurious Emissions 30 – 5 000 MHz. Channel HIGH.

**Peak over the limit is the carrier.**

## Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 15.APR.2013 13:22:51

**Figure 23.** Conducted Spurious Emissions 5 000 – 25 000 MHz. Channel HIGH.



### 6 dB Bandwidth of the Channel

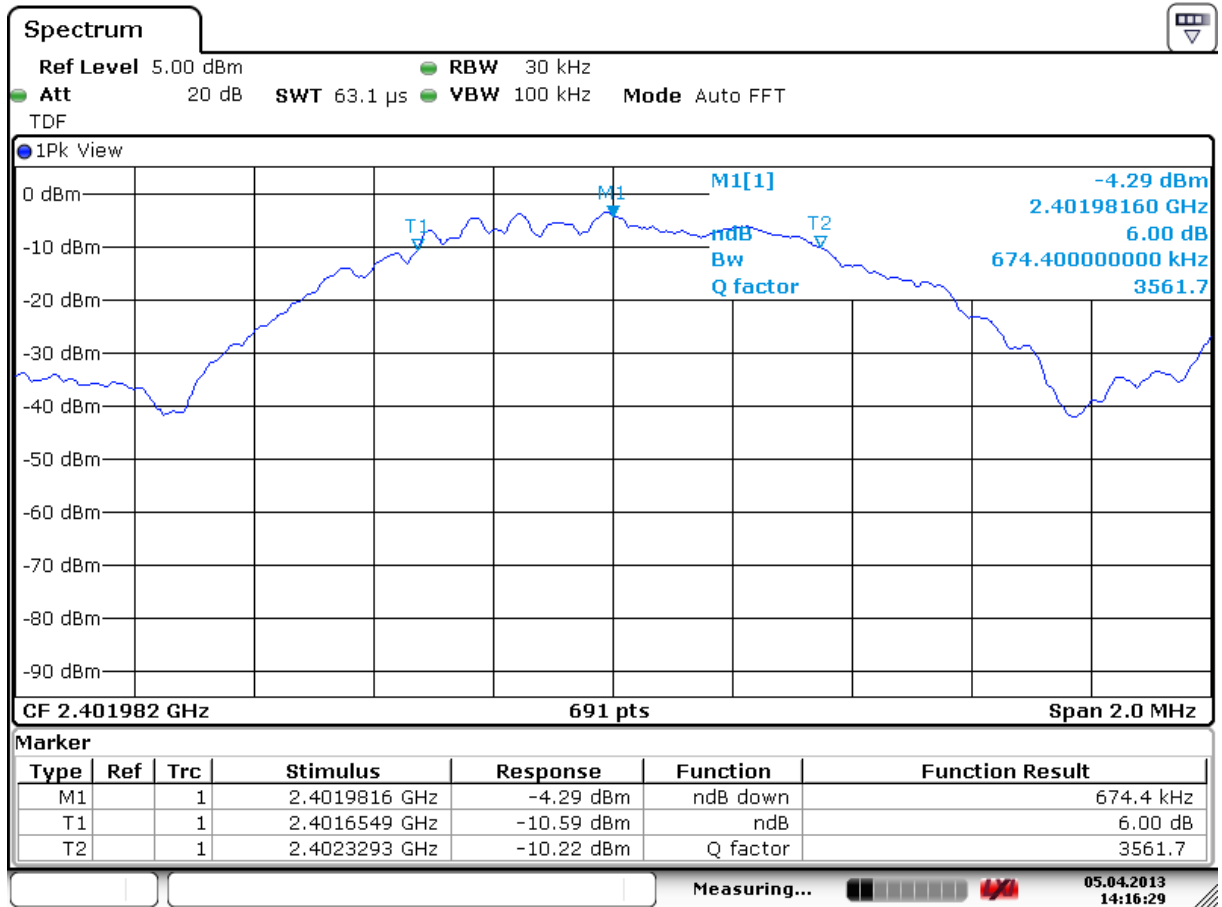
**Standard:** ANSI C63.10 (2009)  
**Tested by:** JJM  
**Date:** 5.4.2013  
**Humidity:** 18 %  
**Temperature:** 23 °C

**FCC Rule: 15.247(a)(2)**

**Results:**

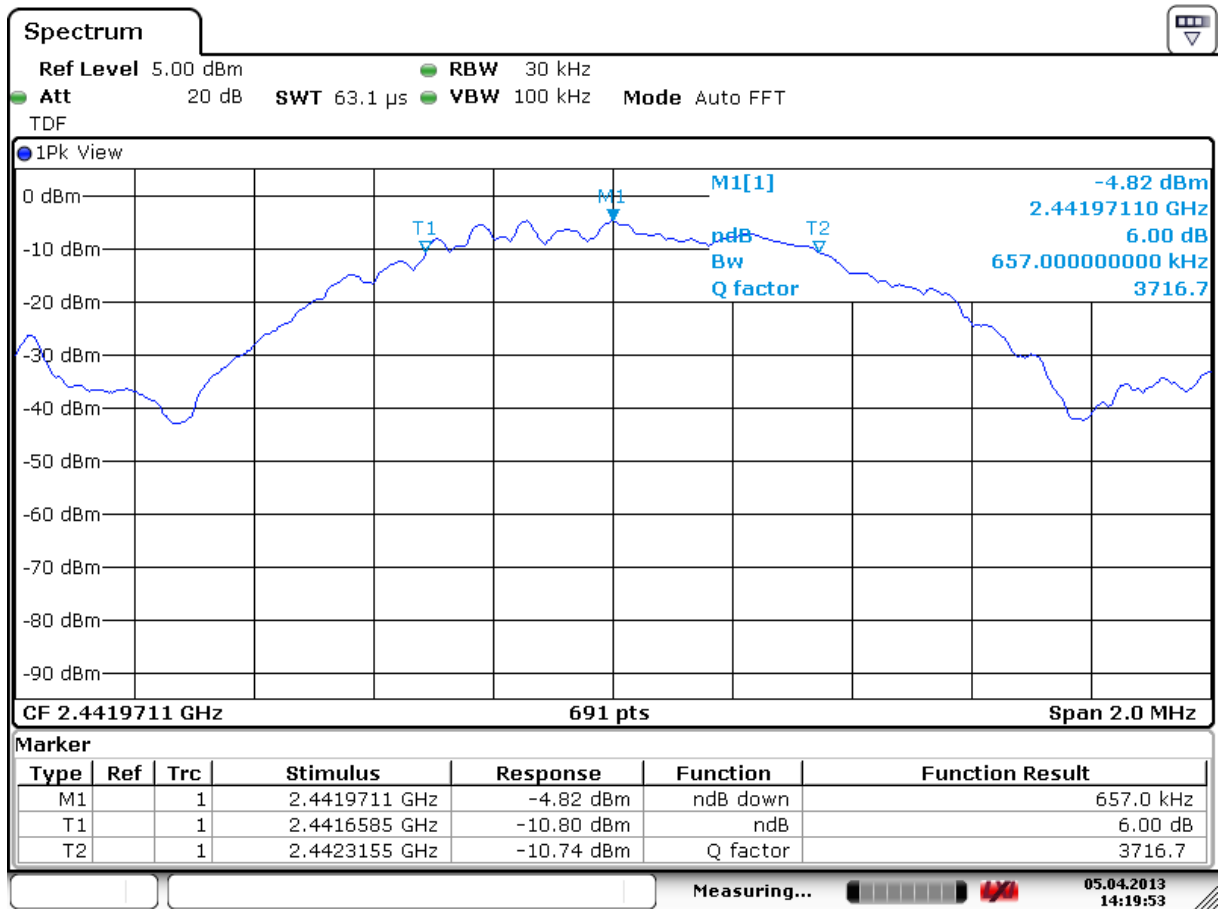
Channel	6 dB BW [kHz]	Minimum limit [kHz]
Low	674.4	500
Mid	657.0	
High	659.9	

**Table 15.** 6 dB bandwidth test results.



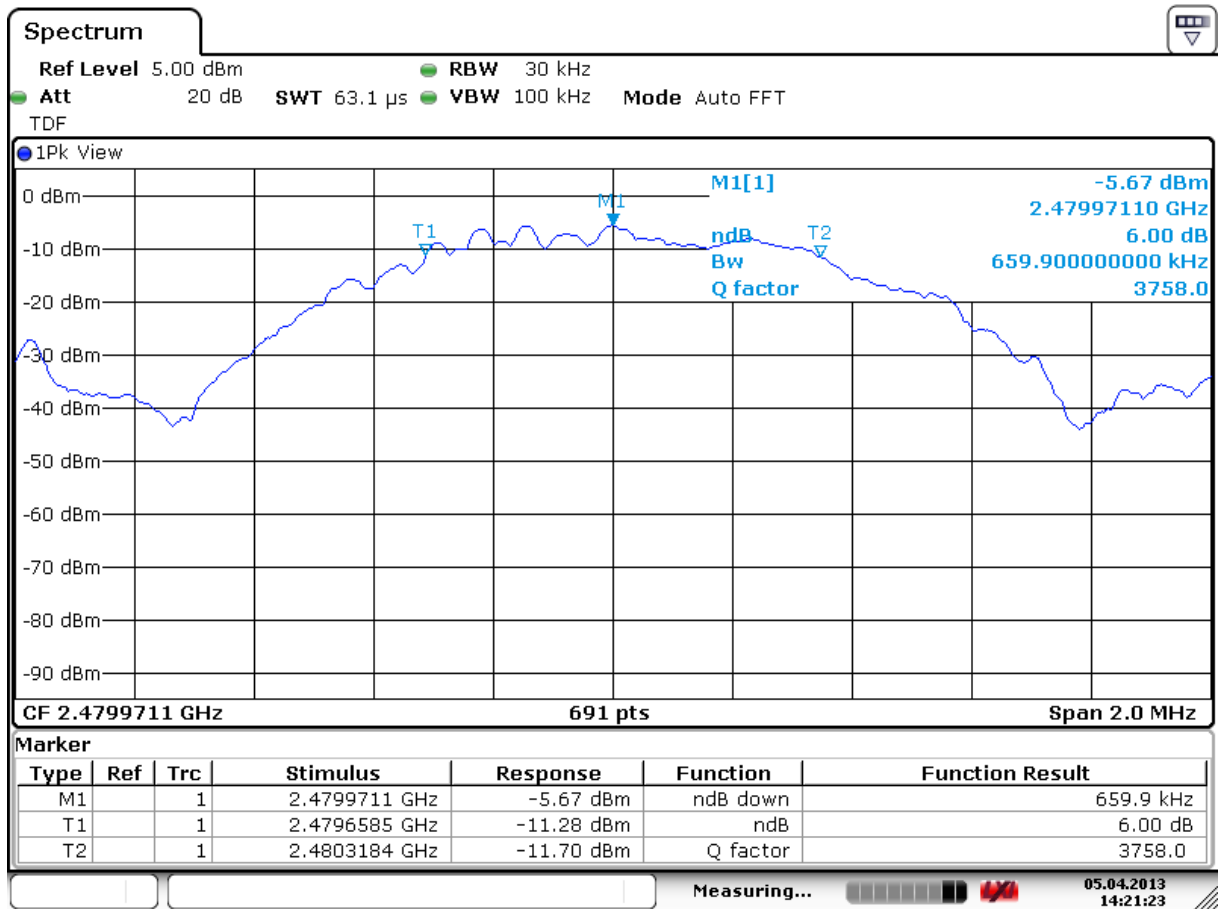
Date: 5.APR.2013 14:16:29

Figure 24. 6 dB channel BW. Channel LOW



Date: 5.APR.2013 14:19:54

Figure 25. 6 dB channel BW. Channel MID.



Date: 5.APR.2013 14:21:23

**Figure 26.** 6 dB channel BW. Channel HIGH

## Power Spectral Density

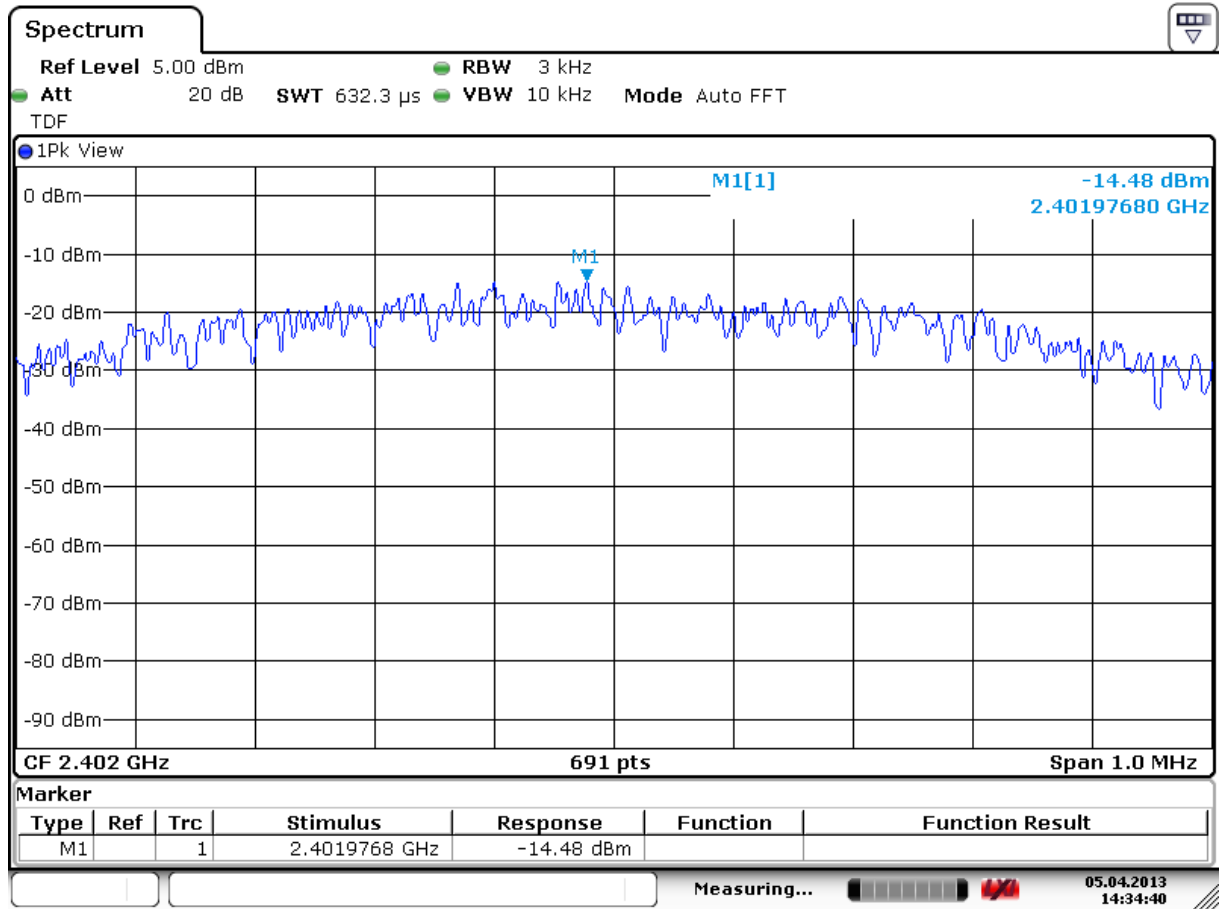
**Standard:** ANSI C63.10 (2009)  
**Tested by:** NTO  
**Date:** 5.4.2013  
**Humidity:** 18 %  
**Temperature:** 23 °C

**FCC Rule: 15.247(e)**  
**RSS-210 A8.2**

**Results:**

Channel	PSD dBm/3 kHz	Maximum limit [dBm/3kHz]
Low	-14.48	+8.00
Mid	-15.52	
High	-16.26	

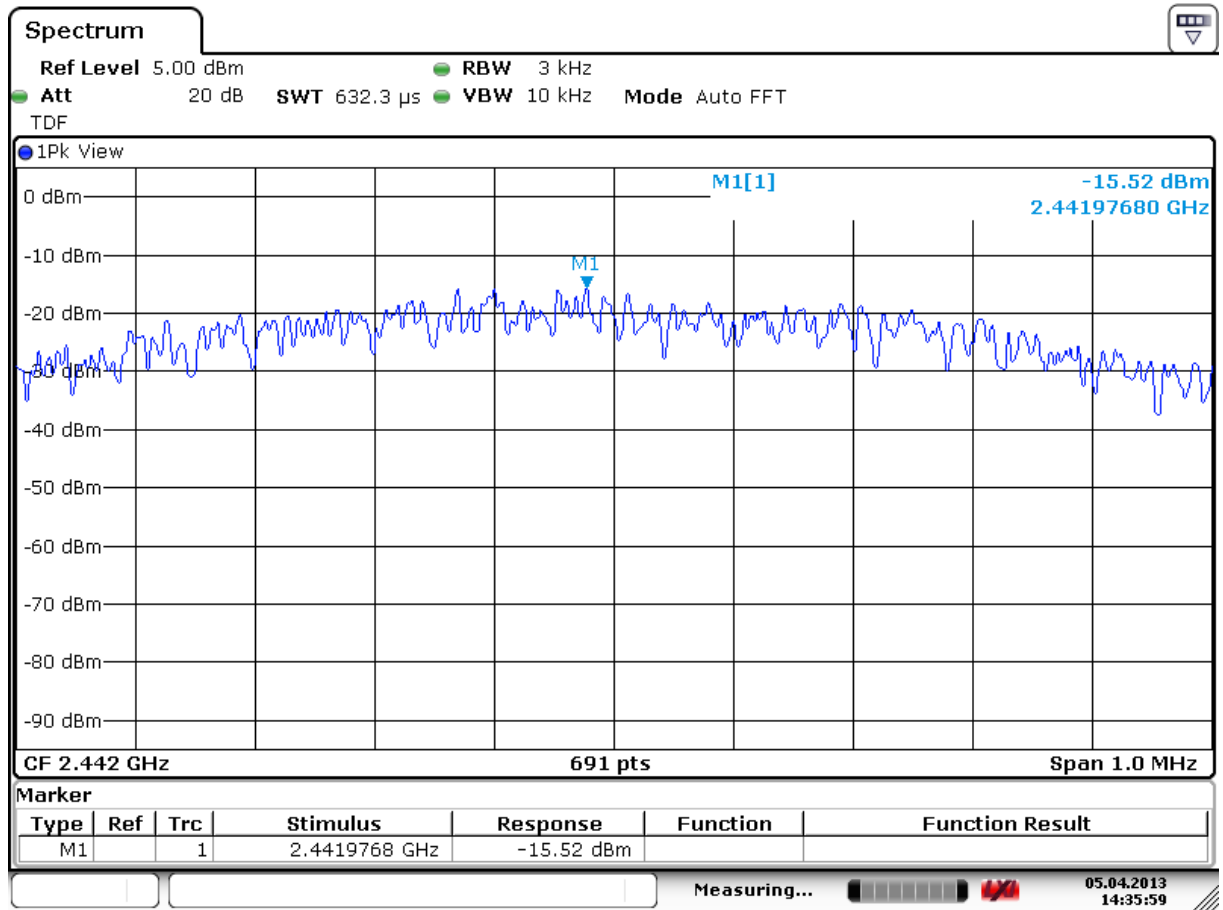
**Table 16.** Power Spectral Density test results.



Date: 5.APR.2013 14:34:40

**Figure 27.** Power Spectral Density of the channel LOW.

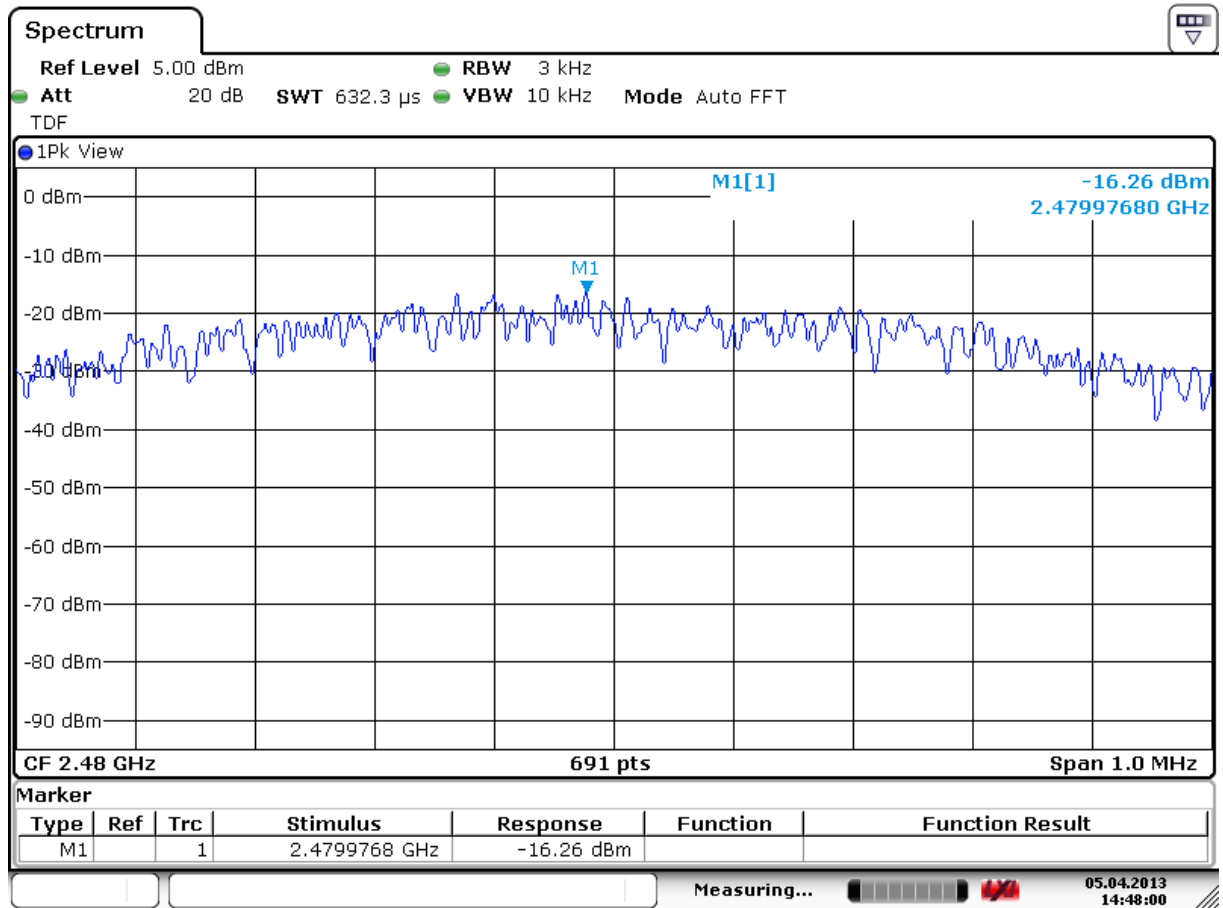
## Power Spectral Density



Date: 5.APR.2013 14:36:00

**Figure 28.** Power Spectral Density of the channel MID.

## Power Spectral Density



Date: 5.APR.2013 14:48:00

**Figure 29.** Power Spectral Density of the channel HIGH.



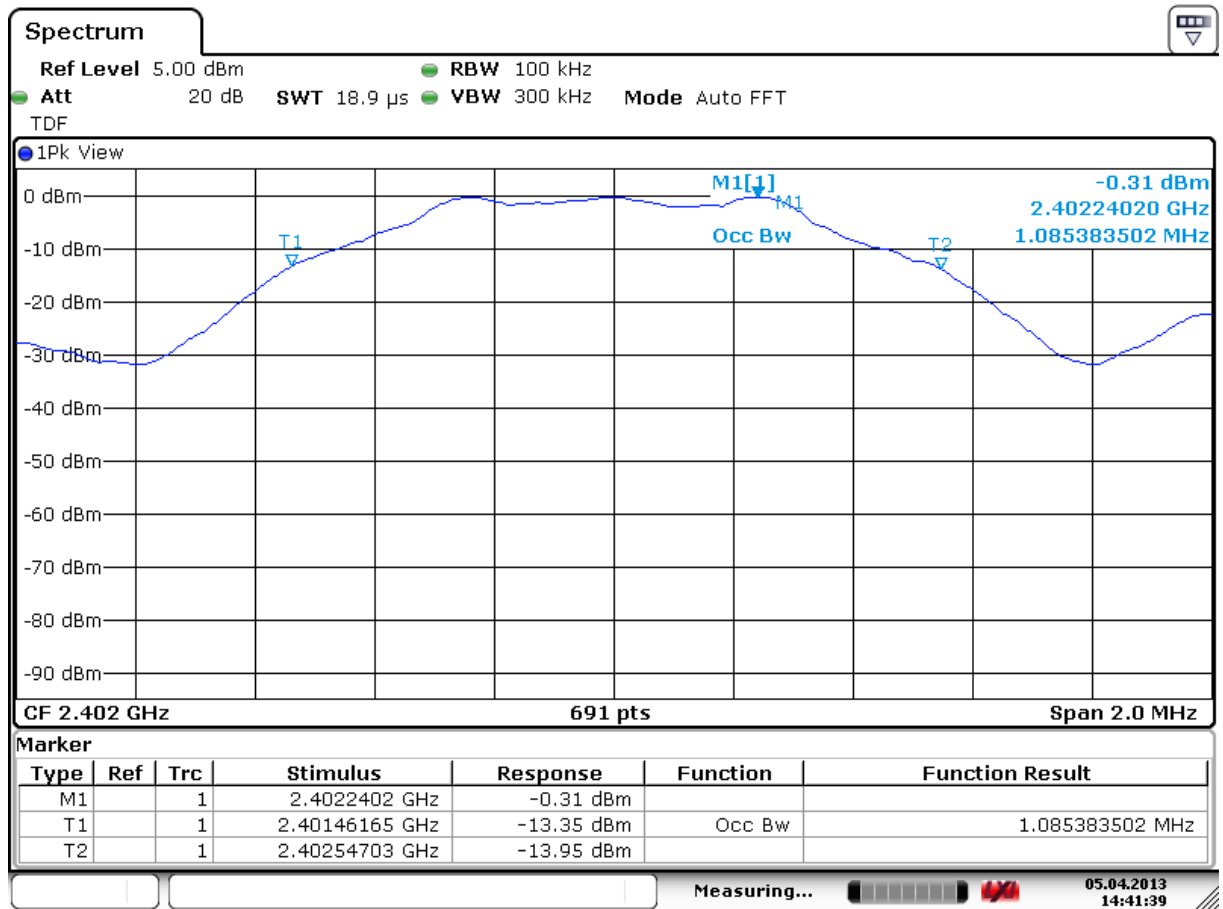
**99% Occupied Bandwidth**

**Standard:** RSS-GEN (2010)  
**Tested by:** JJM  
**Date:** 5.4.2013  
**Humidity:** 18 %  
**Temperature:** 23 °C

**RSS-GEN 4.7**

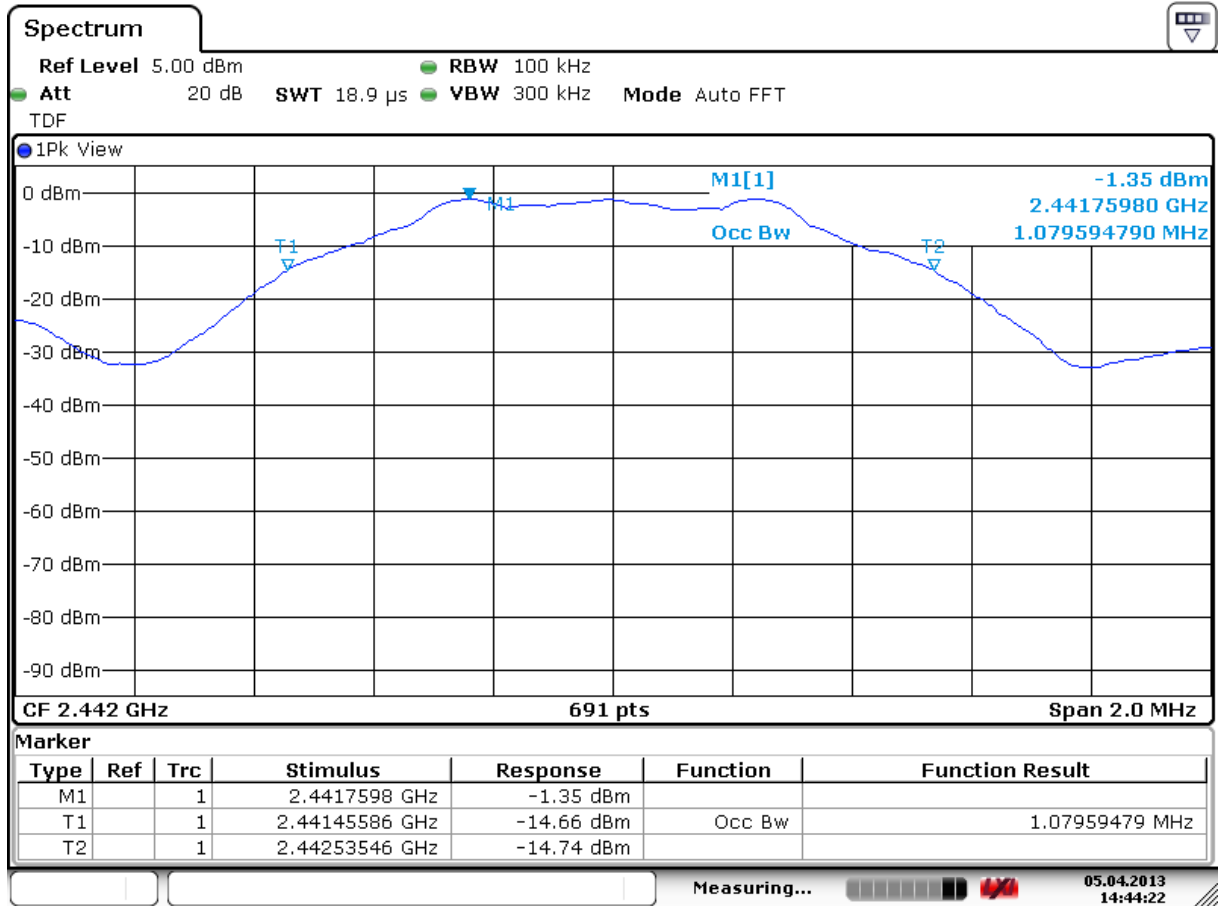
Channel	Limit	99 % BW [MHz]
Low	-	1.08593
Mid	-	1.07960
High	-	1.07960

**Table 17.** 99 % OBW test results.



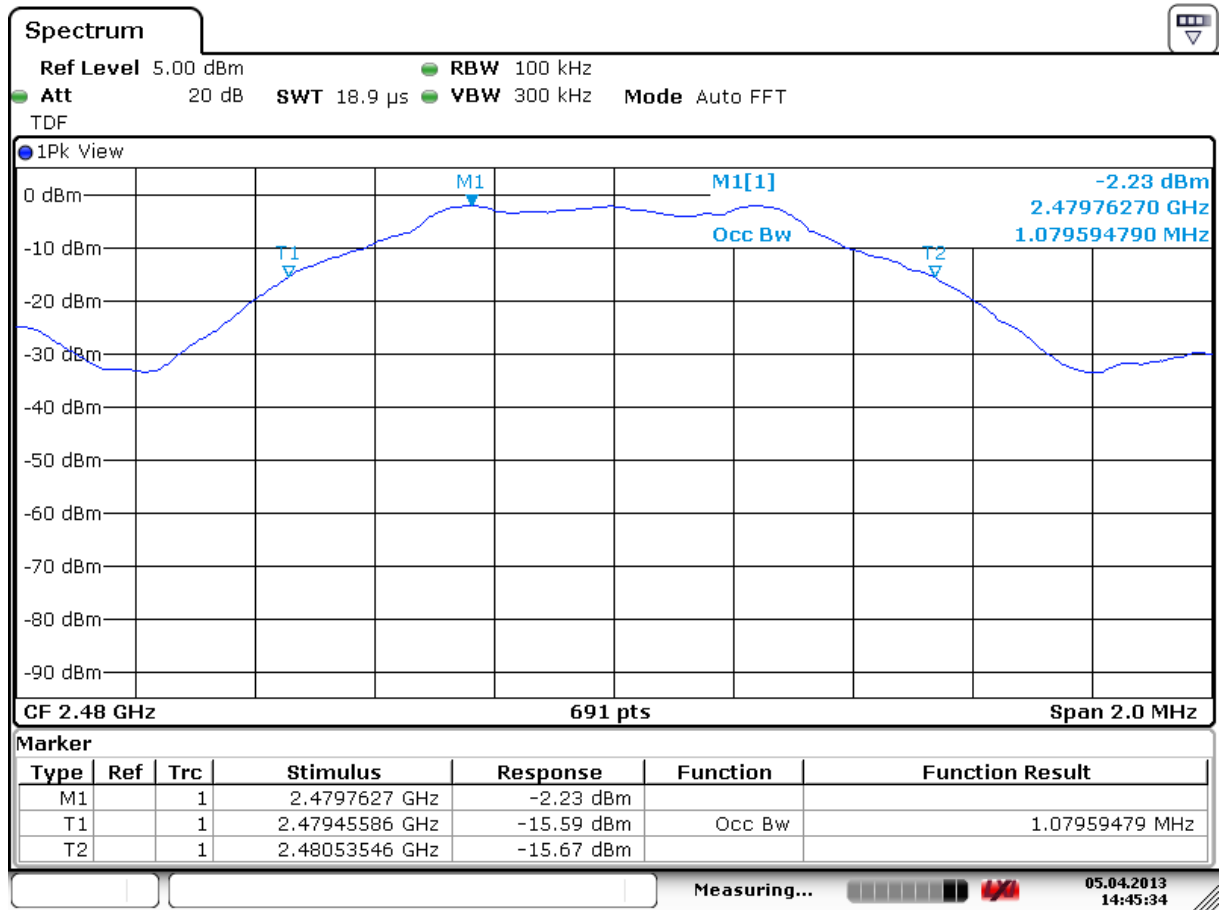
Date: 5.APR.2013 14:41:39

Figure 30. 99 % OBW. Channel low.



Date: 5.APR.2013 14:44:22

**Figure 31.** 99 % OBW. Channel mid.



Date: 5.APR.2013 14:45:34

**Figure 32.** 99 % OBW. Channel high.

### Receiver Radiated Emissions 30 – 26 500 MHz

**Standard:** ANSI C63.10 (2009)  
**Tested by:** JJM  
**Date:** 22 – 23.4.2013  
**Humidity:** 20 - 21%  
**Temperature:** 19 °C  
**Measurement uncertainty** ± 4.51 dB Level of confidence 95 % (k = 2)

#### FCC Rule: 15.109

The EUT was in a receiving mode and measurement was performed using middle channel only.  
 The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables).  
 The QuasiPeak value is the measured value corrected with the correction factor.

#### Measured Peak Values In The Frequency Range 30 MHz - 1000 MHz.

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

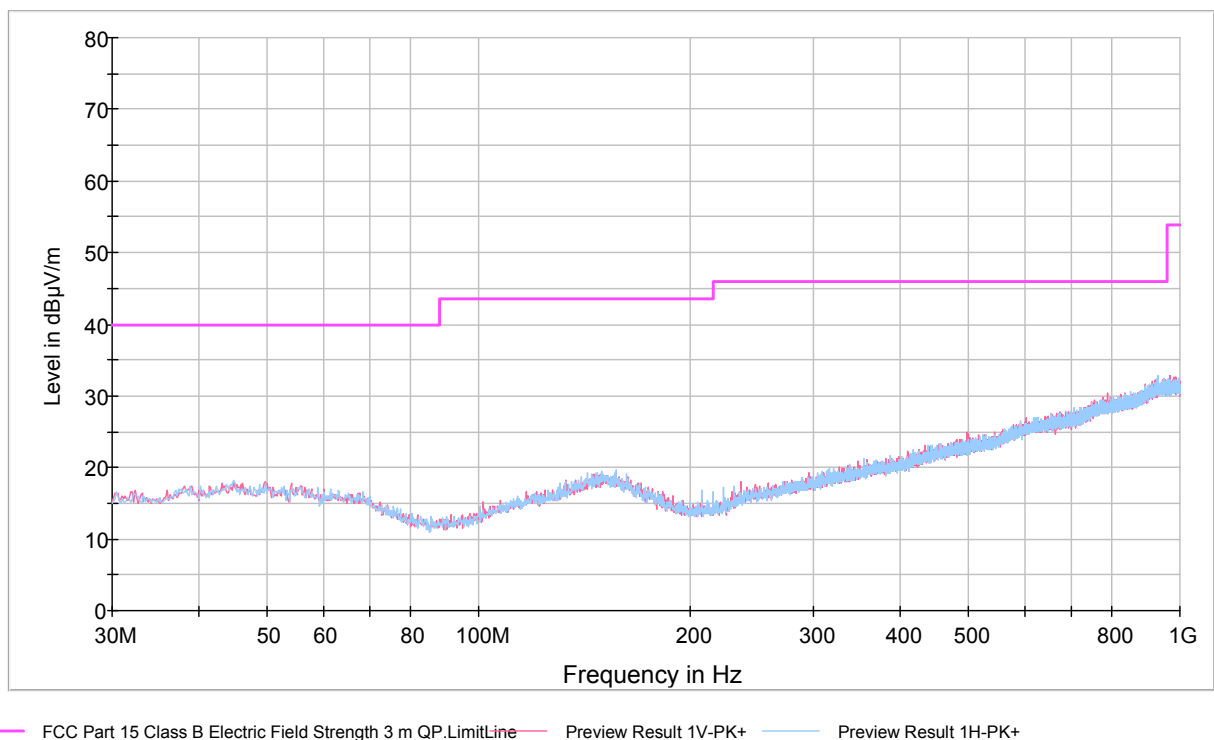
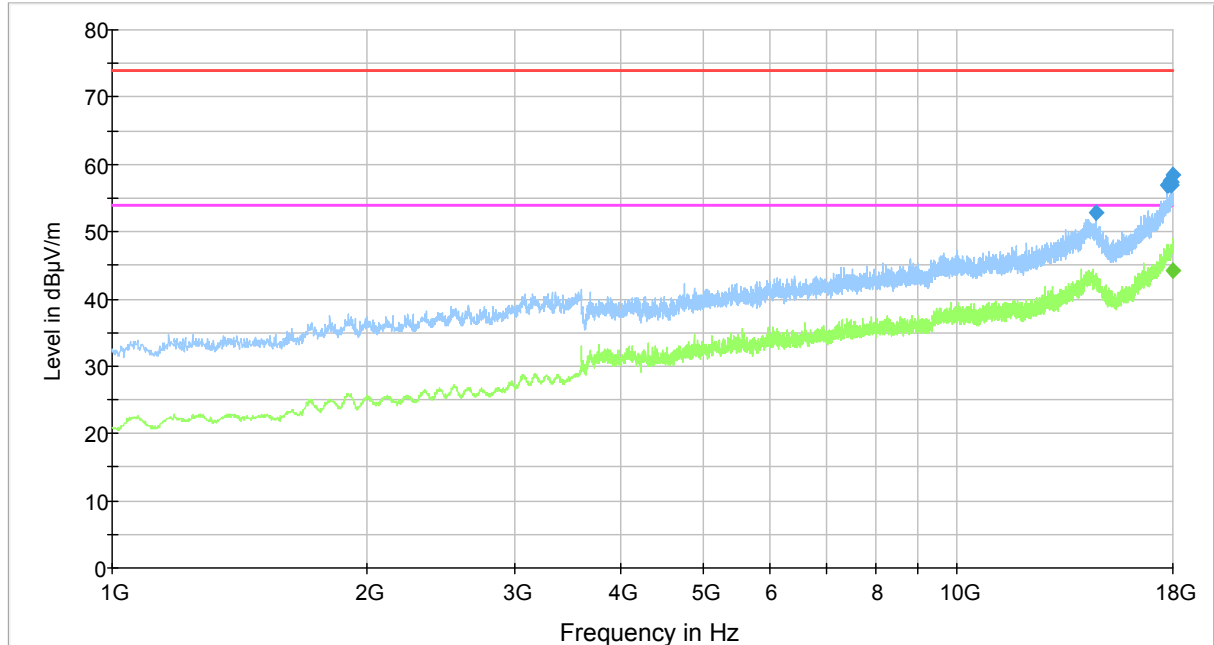


Figure 33. Measured curve with peak-detector.

**No final measurements were made since the emission level was more than 10 dB from the limit.**

Measured Peak Values In The Frequency Range 1 000 MHz – 18 000 MHz.

FCC Part 15 Class B Spurious Emission 1-18GHz 3m Rx



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine  
— FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine  
◆ Preview Result 1-PK+      ◆ Preview Result 2-AVG  
◆ Final Result 1-PK+      ◆ Final Result 2-AVG

Figure 34. Measured curve with peak-and average detector.

Final measurements from the worst frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
14588.200000	52.8	1000.0	1000.000	236.0	H	78.0	23.5	21.1	73.9
17710.800000	57.0	1000.0	1000.000	400.0	H	59.0	28.4	16.9	73.9
17811.000000	56.9	1000.0	1000.000	138.0	V	3.0	28.6	17.0	73.9
17857.900000	57.5	1000.0	1000.000	385.0	H	15.0	28.7	16.4	73.9
17902.200000	57.0	1000.0	1000.000	400.0	H	2.0	29.3	16.9	73.9
17937.400000	57.4	1000.0	1000.000	292.0	H	137.0	29.3	16.5	73.9
17991.300000	58.4	1000.0	1000.000	359.0	H	187.0	29.6	15.5	73.9

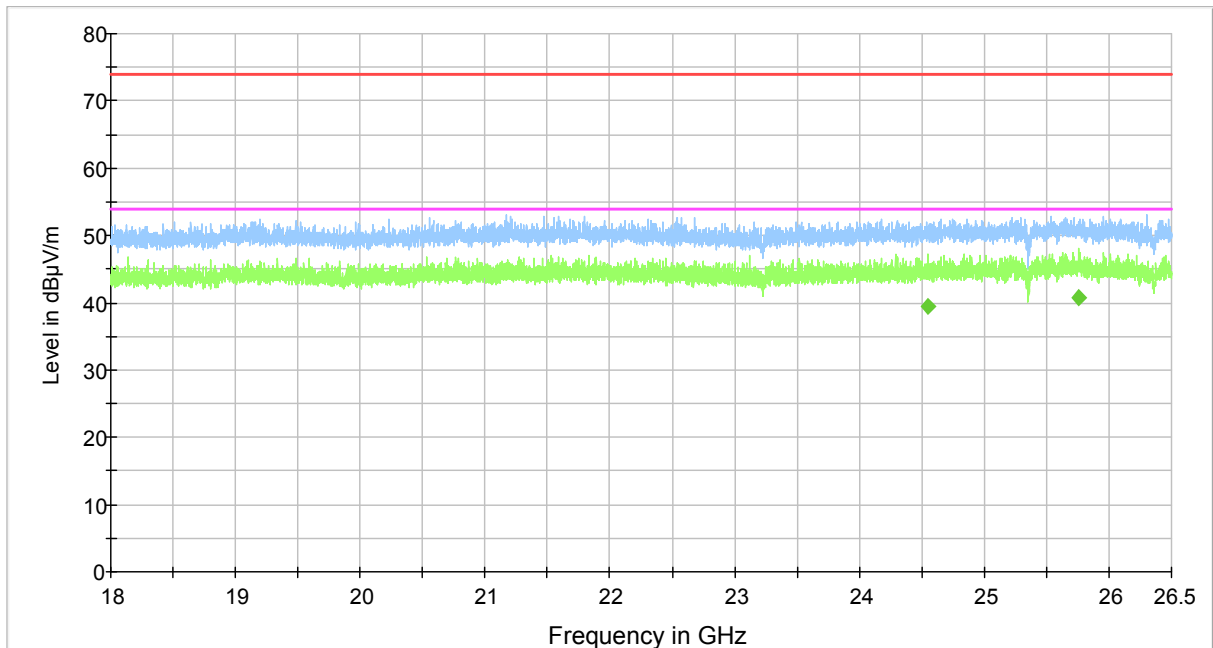
Table 18. Final MaxPeak results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
17976.500000	44.2	1000.0	1000.000	383.0	V	52.0	29.5	9.7	53.9

Table 19. Final Average results.

**Measured Peak Values In The Frequency Range 18 000 MHz – 26 500 MHz.**

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine    
 — FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine  
— Preview Result 1-PK+    
 — Preview Result 2-AVG  
◆ Final Result 2-AVG

**Figure 35.** Measured curve with peak-and average detector.

**Final measurements from the worst frequencies**

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
24544.850000	39.4	1000.0	1000.000	400.0	V	338.0	28.0	14.5	53.9
25757.750000	40.7	1000.0	1000.000	393.0	H	111.0	29.1	13.2	53.9

**Table 20.** Final Average results.

## Conducted emissions

**Standard:** ANSI C63.10 (2009)  
**Tested by:** JJM  
**Date:** 23.4.2013  
**Humidity:** 21 %  
**Temperature:** 20 °C  
**Measurement uncertainty** ± 2,87 dB Level of confidence 95 % (k = 2)

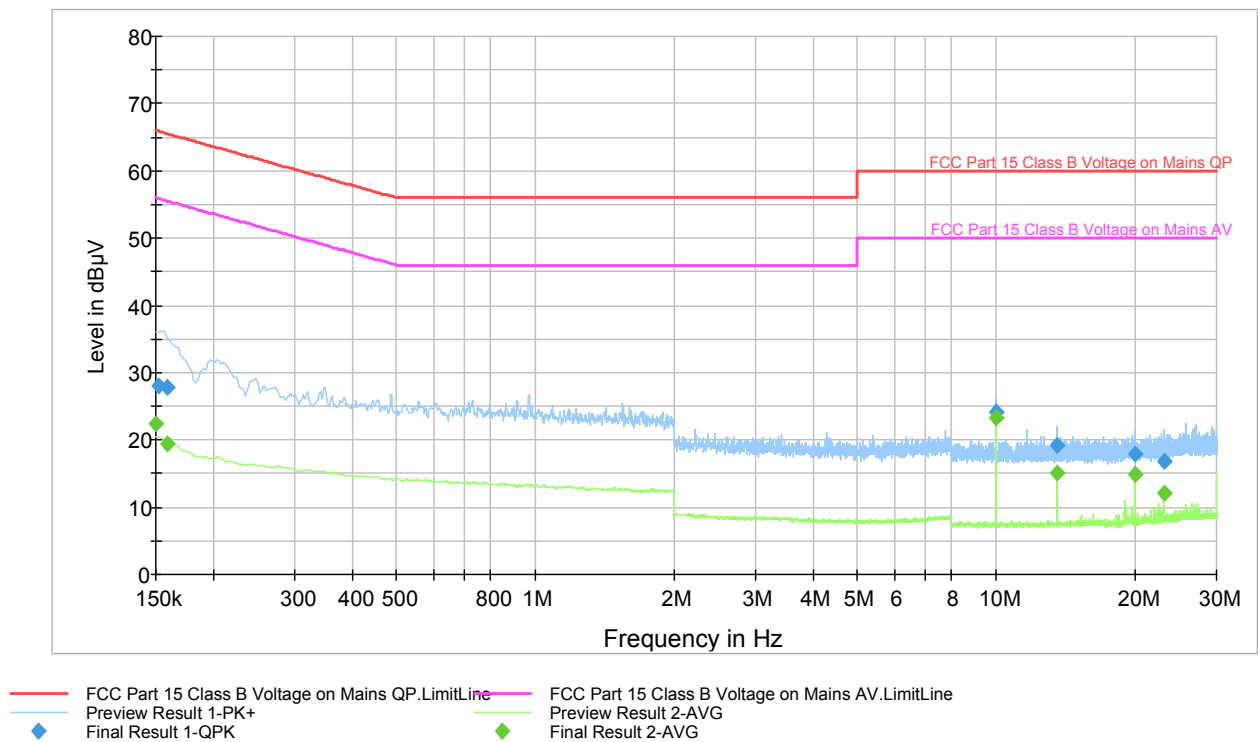
### FCC Rule: 15.207

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with 4.5 kHz steps and a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors.

During the test the EUT was powered from the separate AC / DC power supply which was connected to the LISN. The supply voltage through the LISN to the power supply was 115 VAC / 60 Hz.

### Test results

Conducted Emission Mains FCC Part 15 Class B with ESH3-Z5 8019



**Figure 36.** The measured curves with peak- and average-detectors



**Final measurements from the worst frequencies**

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.152250	28.0	1000.0	9.000	GN	N	10.7	37.8	65.9
0.159000	27.7	1000.0	9.000	GN	N	10.8	37.8	65.5
10.000000	24.2	1000.0	9.000	GN	N	10.9	35.8	60.0
13.559500	19.1	1000.0	9.000	GN	L1	11.1	40.9	60.0
19.999000	17.8	1000.0	9.000	GN	N	11.3	42.2	60.0
23.126500	16.9	1000.0	9.000	GN	L1	11.6	43.1	60.0

**Table 21.** Final quasi-peak measurements from the worst frequencies

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	22.3	1000.0	9.000	GN	L1	10.7	33.7	56.0
0.159000	19.4	1000.0	9.000	GN	N	10.8	36.1	55.5
10.000000	23.2	1000.0	9.000	GN	L1	10.9	26.8	50.0
13.559500	15.0	1000.0	9.000	GN	L1	11.1	35.0	50.0
20.001250	14.9	1000.0	9.000	GN	L1	11.5	35.1	50.0
23.128750	12.0	1000.0	9.000	GN	L1	11.6	38.0	50.0

**Table 22.** Final average measurements from the worst frequencies

The correction factor in the final result tables contains the sum of the transducers (cables + transient limiter + LISN).

The QuasiPeak and Average values are the measured values corrected with the correction factor.

**List of test equipments**

<b>Manufacturer</b>	<b>Type</b>	<b>Serial no</b>	<b>Inv. no</b>
<b>ROHDE &amp; SCHWARZ</b>			
Spectrum analyzer	FSV40	101068	9093
EMI Test receiver	ESU 26	100185	8453
Test software	EMC32	Ver. 8.30.0	-
LISN	ESH2-Z5	863794/014	8019
Transient limiter	ESH3-Z2		8396
Antenna (1 – 18 GHz)	HF906	10083	7910
<b>DAVIS</b>			
Weather station	Vantage Pro	-	5297
<b>EMCO</b>			
Antenna (1 - 18 GHz)	3117	29617	7293
<b>SCHWARZBECK</b>			
Antenna (30 MHz - 1 GHz)	VULB9168	9168-503	8911
<b>HEWLETT- PACKARD</b>			
Microwave amplifier	83017A	-	5226
<b>HUBER-+ SUHNER</b>			
Attenuator 10dB	6810.17B	-	-
<b>DEISEL</b>			
Antenna mast	MA 240 T	240/394/96	5017
Tilt option	KE 220	220/307/96	-
Controller	HD 100	100/413/96	5018
Turntable	DS 420	420/420/96	5015
<b>WAINWRIGHT</b>			
High Pass Filter	WHKX	10	8267
<b>CALIFORNIA INSTRUMENTS</b>			
Power Supply	5001 iX Series II	58209	7826

**Calibration was valid to all equipment use in testing.**